ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

BOMBAY PRESIDENCY

FOR THE YEAR 1919-20 1921-22

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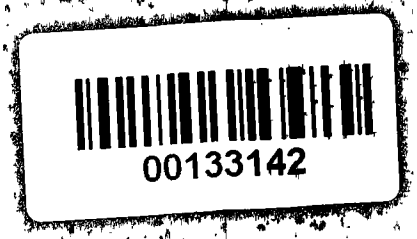

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CONTENTS.

	Paragraph.	Pages.
Introductory ...	1	1
CHAPTER I.		
ADMINISTRATION.		
Expenditure, Receipts ...	2	1
Changes in the personnel due to leave ...	3	1—2
CHAPTER II.		
SEEDS.		
Summary of the progress made introducing the four strains of improved Surat I-A cotton ...	4	2
South Gujarat ...	5	2
N. R. Cotton in Khandesh ...	6	2—3
Dharwar No. 1 in Kumta tract ...	7	3
Gadag No. 1 in the Dharwar American tract ...	8	3
Punjab American F. 4 takes place of triumph in Sind N. R. cotton most in Sind cotton mixture ...	9	3
The work of the Plant Breeding Expert ...	10	3—4
CHAPTER III.		
GENERAL FARMING MATTER.		
Implements—their stock and sale, Iron ploughs, kept for hire by Agricultural Associations and Co-operative Societies ...	11	4
Artificial Manures—Popularity gained by Sulphate of Ammonia for Sugarcane, Union Agency's manure mixing factory in Poona, demand for bone meal ...	12	4
Cattle Breeding.—Pedigree bulls. Using she buffaloes for ploughing in the Konkan profitable to small holders ...	13	4—5
Question of fodder of greatest importance in connection with cattle breeding ...	14	5
CHAPTER IV.		
AGRICULTURAL EDUCATION.		
Agricultural College—and its increasing popularity ...	15—16	5
Agricultural Schools—six new ones projected good openings for such schools ...	17—19	6
CHAPTER V.		
AGRICULTURAL ENGINEERING.		
Well-boring, pumping plants, Motors tractors for ploughing ...	20—23	6—7
CHAPTER VI.		
PROPAGANDA.		
Bulletins, Leaflets, Vernacular Magazine, Agricultural Shows and Village Demonstrations ...	24—25	7—8

		Appendix.	Pages.
Report of the Agricultural College	...	A	9- 16
Report of the Marathi Agricultural School, Loni	...	B	17- 21
Work done under the Dy. Director of Agriculture, Gujarat	...	C	22- 47
Do. do. do. Central Division	...	D	48- 58
Do. do. do. Southern Division	...	E	59- 71
Do. do. do. Konkan	...	F	72- 95
Do. do. do. Sind	...	G	96-117
Do. do. Professor of Agriculture	...	H	118-121
Report of the Agricultural Chemist	...	I	122-125
Work done under the Economic Botanist	...	J	126-130
Annual Report of the Plant Breeding Expert	...	K	131-132
Annual Report of the Agricultural Engineer	...	L	133-141

No. 12368 of 1920.

From

G. F. KEATINGE, Esq., C.I.E., I.C.S.,
Director of Agriculture,
Bombay Presidency,
Poona.

To

The CHIEF SECRETARY to GOVERNMENT,
Revenue Department,
Bombay.

Poona, 16th October 1920.

Subject.—Annual Report for 1919-20.

Sir,

I have the honour to submit herewith the Annual Report of the Agricultural Department for the year 1919-20..

CHAPTER I.

Administration.

2. During the year the expenditure of the Department amounted to Rs. 13,09,000, as against Rs. 12,57,000 of the year before. Of this sum Rs. 2,76,000 represents special expenditure connected with such famine operations as cattle camps, special fodder production, provision of seed, &c. Receipts amounted to Rs. 4,22,000, as against Rs. 2,86,000 of the previous year. As regards the Personal Ledger Account used for financing quasi-commercial operations, Rs. 40,000 were advanced and Rs. 49,000 recovered during the year. The Sir Sassoon David Trust Fund made a grant of Rs. 1,09,000 to this Department for the assistance of certain definite works of investigation and propaganda, of which Rs. 23,000 were actually received during the year.

3. There were many absentees during the year amongst the Officers holding the principal posts in the Department which were filled as follows :—

Office.	Permanent Holder.	Acting Officer.
Director of Agriculture ...	Mr. G. F. Keatinge, C.I.E., I.C.S.	Dr. H. H. Mann, D.Sc.
Dy. Directors ...	Mr. T. F. Main, D.Sc. ...	Mr. Gulmahomed.
	Mr. P. C. Patil, L.Ag. ...	Rao Saheb M. L. Kulkarni.
	Mr. T. Gilbert, B.Sc. ...	
	Mr. V. H. Gonehalli, L.Ag.	Mr. V. G. Gokhale.
Principal, Agricultural College.	Dr. H. H. Mann, D.Sc. ...	Mr. J. B. Knight, M.Sc.
Professor of Agriculture ...	Mr. J. B. Knight, M.Sc. ...	In addition to his own duties as Professor of Agriculture.
Agricultural Chemist ...	Dr. H. H. Mann, D.Sc. ...	Mr. D. L. Sahasrabudhe, L.Ag., B.Sc.
Economic Botanist ...	Dr. W. Burns, D.Sc. ...	Mr. S. L. Ajrekar, B.A.
Agricultural Engineer ...	Mr. W. M. Schutte ...	Mr. Thiselton Dyer.

In view of the fact that I was absent during almost the whole year under report, and the officers in charge of the various divisions and special branches have submitted detailed reports of the work done under them, which are printed as appendices, I propose to submit only a brief report this year. I should have wished to be able to give the financial results of the famine operations undertaken by this Department during the last two years, but I regret to state that the accounts of these operations are not yet finally made up.

CHAPTER II.

SEED.

4. Details regarding the four principal strains of improved cotton which we are introducing in this Presidency are given in paras. 5 and 6 of the report of this Department for the year 1917-18, and I propose to summarise the progress that has been made in introducing them. Temporary establishments for this purpose have been sanctioned for Gujarat and the Southern Maharatha Country, and proposals are now being made for permanent establishments to deal with the production, maintenance and distribution of superior cotton seed in the chief cotton tracts of the Presidency, based on the recommendations of the Indian Cotton Committee.

5. *Surat I. A. for South Gujarat.*—It will be seen from Appendix No. C that it has been decided to distribute two strains in South Gujarat, Surat I. A. for the Surat region, and 1027, A. L. F for the Navsari tract. In accordance with the settled plan an area of 6,000 acres was sown with selection I. A. This area was closely supervised by the staff, and the fields were rogued and the cotton marketed and sold by auction under departmental arrangements, with the help of a local committee. In this way 553 Khandis of lint were auctioned at a premium of from Rs. 22 to Rs. 75 above the ordinary price of Surat Cotton. Both the cultivators and the purchasers of the cotton expressed their satisfaction with the operations. So far the work was comparable with similar work done in this tract in previous years, but an advance is indicated by the fact that with the new establishment we have been able to distribute over one million lbs.; of this seed for sowing during the current season, whi h will suffice for at least 60,000 acres. We shall not attempt, as we once previously tried to do, to be responsible for the collection and marketing in a pure state of the crop grown from this seed. If cultivators and dealers lay themselves out to market it in an impure state, mixed with short stapled varieties, nothing that this Department can do will avail to stop them, but we can at least claim that at a time when the cotton grown in this tract which grows the best cotton in the Presidency has become so mixed that there is hardly any other pure seed available, we are able to put out a large quantity of pure seed of a strain which is substantially superior to ordinary pure Surat cotton, both from the agricultural and from the manufacturing points of view, and we are prepared to continue to do this year by year and to increase the scope of our operations in proportion as they result in pure cotton coming into the market. There is no doubt that during the past season a very large quantity of short stapled cotton was imported into this tract for the purpose of fraudulent mixing and leading members of the cotton trade have expressed the opinion that no material advantage can result from our activities so long as these fraudulent practices prevent the cotton from being marketed in a pure state. The marked difference in price during the past year, however, between Surat and Broach cotton which amounted to Rs. 150 per Khandi in favour of the longer stapled cotton, and the fact that the Cotton Contracts Board in Bombay has been strict in not passing inferior and adulterated cotton as genuine Broach should do much to make both the cultivators and the dealers realise where their true interest lies, and the legislation to control the movements of cotton proposed by the Indian Cotton Committee, if carried into effect, should produce most beneficial results.

6. *N. R. Cotton in Khandesh.*—The work in connection with this cotton was carried on, as before, by the ordinary staff, and the value to the cultivator of

N. R. cotton as compared with the ordinary Khandesh mixture is now so generally appreciated that we have been able to turn over the bulk of this distribution work to Co-operative Societies and Seed Unions and all that the Department did was to supply 1,32,000 lbs. of seed direct to the farmers. Field trials again demonstrated that N. R. Cotton paid the cultivator much better than the longer stapled varieties in the Khandesh mixture, and so long as we have nothing more profitable to distribute it must be our policy to push this variety. It cannot, however, be regarded as wholly satisfactory that we should push a cotton with such an admittedly short staple, especially in view of the present tendency for prices to widen between the long and short stapled varieties, and the results obtained during the past season for a strain of a Comilla Bani cross is very satisfactory (*vide* Appendix D). It still has to be tested on a field scale and to be seen how far the advantage obtained on our Farms in a year of good rain-fall can be secured under ordinary cultivators' conditions and in years of short rain-fall.

7. *Dharwar No. 1 in Kumta tract.*—Here as in Gujarat a special temporary staff was engaged to deal with the distribution of improved cotton seed and the marketing of the produce. Dharwar No. 1 cotton was grown on an area of 3,500 acres and the produce was auctioned by a Cotton Sale Societies and obtained a fair premium over local cotton amounting to Rs. 20 per Naga which means about Rs. 4 per acre. This strain was selected largely on account of the fact that it was regarded as advantag ous from the agricultural point of view, (*i. e.*, in respect of yield) and it was expected that it would rapidly find favour with the cultivators on this account. It has beaten local cotton in point of yield so consistently on the Dharwar Farm over a long series of years, and no trouble in this respect was expected. After a two years' trial, however, the cultivators of the principal locality where it was distributed have come to the conclusion that it yields less than ordinary Kumta cotton, and in some places there is not much desire to take up the seed, in spite of the fact that the produce gets a premium for quality. How far this opinion of the cultivators is justified it is at present difficult to say. The figures of yield obtained on the Dharwar Farm, and the figures obtained by tests in cultivators' fields do not bear out their contention, but on the contrary show an advantage in yield for Dharwar No. 1. The opinion of the cultivators may be partly due to the fact that during the two years, that we have distributed it on a large scale, the season was very bad one year, and only moderate during the second year. It is a fact, however, that this cotton has a more upright habit of growth than the ordinary Kumpta cotton, and needs to be sown somewhat thicker. On our farms where proper spacing is observed this would not tell against it; but in cultivators' fields where the stand of cotton is ordinarily very poor, this might easily tell against it in a bad or poor year. If this is the cause of the adverse opinion it can be removed by the thicker sowing, but it is unfortunate that a check in the work should have occurred. At the end of the season, however, we had seed for 3),000 acres, and this has been distributed in fresh tracts, and careful estimates of relative yield will be made.

8. *Gadag No. 1.*—In the Dharwar American tract, this strain has, as was expected, found favour, and is being rapidly taken up. Apart from areas sown with seed from previous distributions and which has now become somewhat mixed, 1,200 acres were sown with pure Gadag No. 1 during the past year, and some 10,000 acres will be sown with it during the present season, since there is a keen demand for the seed. At the auctions Gadag No. 1 obtained a premium of about Rs. 65 per Naga or Rs. 16 per acre grown.

9. In Sind the attempt to push "Triumph" cotton has been given up but Punjab American F 4 has been found to compare well with local cotton from the agricultural point of view, and fetches Rs. 2 to Rs. 3-8-0 more, per maund. There is a fair demand for this type and 70,000 lbs. of seed have been distributed. Selection in the local Sindi mixture has given the same results as in Khandesh, *viz.*, that N. R. cotton is the most profitable in the mixture. This seed is, therefore, being multiplied.

10. The work of the Plant Breeding Expert has not yet reached a stage that enables him to put out any pure line strains; but he is narrowing down his

selections in wheat and rice, and in a few years his work should bear practical results. Punjab No. 11 and Pusa No. 12 wheats have been introduced into Sind and have obtained considerable popularity there. Apart, however, from pure strains, large quantities of seed are now distributed all over the Presidency from our Farms and Depots, and the seed of jowari and rice obtained from our Farms by mass selection is in considerable demand, and undoubtedly gives much better results than seed not so selected. New sugarcane varieties suited to various tracts and conditions are coming into common use, and fruit trees of many kinds have been widely distributed. In addition to this there is considerable demand for good seed of well known varieties and we make an effort to meet this demand as far as possible. Potatoes, rice, jowari, bajri and gram were provided on a considerable scale to meet the demand. I am glad to say that a private firm is taking up seedsman work on a large scale and we are able to turn over to it some of this quasi-commercial work already. Groundnuts are still distributed on a fairly large scale, but the popularity of this crop has now been so widely spread, that it is not now necessary to undertake such extensive operations of this kind as formerly.

CHAPTER III.

General Farming Matters.

11. The implement campaign still remains one of our most important forms of activities, and is carried on by the demonstration and sale of implements on our farms, by the sale and hire of implements from many depots and by means of ploughing competitions and itinerant demonstrations. Our work has had very considerable results and there are now many parts of the Presidency where iron ploughs are in regular use in large numbers, and it has been noted that the results are distinctly and obviously beneficial. In some tracts it has become quite a business to keep a number of iron ploughs for hire, and several Agricultural Associations and Co-operative Societies undertake this work on a considerable scale. Cultivators and dealers in many tracts n w buy their ploughs freely from the local factory and from importers so that our work in this connection is proportionately reduced, and we are enabled to take the propaga da to fresh tracts. The rise in prices and the short supply of imported implements has checked the introduction of modern harrows and seed drills, but there can be no doubt that these have a good future in India. It is also satisfactory to note that the operations of drilling and interculturing have been successfully introduced in Sind on the Jamrao Canal in place of broadcasting, and are gaining in popularity.

12. The supply of artificial manures has remained very short, but sulphate of ammonia is becoming popular for application to sugarcane in many tracts. About 5 0 tons were used in the Presidency during the past year and now that the supply is becoming larger the use of this fertiliser is likely to increase rapidly in the near future. The supply of some concentrated manures is still very scanty, but cultivators are becoming interested in their use for various garden crops, and as the supply increases they will be taken up by degrees. The Union Agency have now started manure mixing in Poona and this Department has supplied them with the assistance of a chemist as promised by Government. The very striking success of bone meal applied to rice on laterite soils, as demonstrated on our farms is being appreciated by cultivators, and a small demand for bone meal is now beginning, which should rapidly increase.

13. In connection with cattle the only pedigree bulls that we have to distribute are Kankrijis from the Chharodi and Surat Farms, and Karachi bulls from the Dairy Farm. Kankriji bulls are being put out on the premium system, and we have been purchasing Khillari bulls in the open market to supply to breeders in the Deccan. As regards these last we know nothing of their breeding and have to judge by appearance, and, as may be imagined, the results are often not satisfactory. I am glad to say that the buildings for the Bankapur Cattle Farm are now nearing completion, and pure bred Mysore Cattle are

now being purchased to form the nucleus of a herd. This herd will in time supply bulls for the Southern Maharatha country, and very possibly to a considerable part of the Deccan. She buffalo bulls kept for the use of the public on our farms are fairly used, and the experiment of using the buffaloes for ploughing in the Konkan shows that such a development is quite possible and should be profitable to small holders.

14. The question of fodder is of the greatest importance in connection with cattle breeding; for in tracts where fodder famine is chronic little success can be hoped for in improving the type of cattle. In such tracts small, hardy cattle have a survival value which, for the poorer cultivator, puts them ahead of the larger cattle which the effective tillage of the soil demands. Without referring to the larger fodder operations of Government which pour grass into the affected districts in years of famine, I may mention that the local storage of fodder at Chharodi and Kopergaon continues, and these supplies are very useful when shortage occurs. During the past few years the trouble has been that fodder shortage has occurred so frequently that we have not been able to build up the reserves that we had hoped to store against famine. Proposals have been made for shredding and baling Kadbi on a large scale at Karajgi in the Dharwar District. Efforts are being made to popularise various fodder crops, a number of silos have been constructed in various parts of the Presidency in which Jowari Maize grass and cane tops are stored, the use of mowers and chaff cutters is being demonstrated and the use of prickly pear as a rough feed for cattle is being widely advocated. Some results are being secured from this campaign, but the progress is slow. No improvement in the fodder supply can be obtained unless people are prepared to undergo some expenditure in this matter, and people are very reluctant to do this, as a business proposition, because the returns from the average cattle are so small. The cattle breeding industry, speaking generally, rests on an uneconomic basis; and it is very difficult to suggest any acceptable remedy for the present state of affairs.

CHAPTER IV.

Agricultural Education.

15. The number of students attending the Agricultural College shows a marked increase and now stands at 203 as against 170 in 1919, and 115 in 1916. If it were not for the temporary accommodation that we have secured in the sheds erected on the College Farm for the Deccan War Hospital, it would not be possible to accommodate so many. These buildings provide for the present influx of students, but they are only of a temporary nature, and further accommodation of a permanent nature will be required in the near future if we are to continue to expand or even to maintain our present position. It is not only in the matter of buildings, however, that the increase in the number of students presses heavily on us, for the existing staff is not sufficient to deal effectively with the increased numbers and with the specialization in various subjects which now forms part of the syllabus. It is hoped that financial considerations will permit of an increase in this staff at an early date.

16. Of the 203 students now at the College 136 belong to the Bombay Presidency and 67 come from other parts of India and from Ceylon. It is remarkable that a considerable number of students joined the Poona Agricultural College not only from adjoining provinces and States but from localities so far afield as the United Provinces, Bengal, Assam and Burma. These students from the distant parts introduce fresh ideas and a healthy variety into the College life and are a distinct asset. We are glad to have them; but if the demand for admission from this Presidency continues to increase it may be necessary in the near future to restrict admissions from outside the Presidency. Meantime the College continues to serve a very wide area in the matter of agricultural education. The results of the examination were satisfactory, and I think that there is no doubt that the College provides a sound and varied education.

17. The following Agricultural Schools are now at work, and the number of students at each school is shown below :—

		1st year.	2nd year.
Marathi	Loni ...	25	18
	Jambul ...	10	15
	Alibag ...	11	11
Kanarese	Devi Hosur ...	14	13
Gujarathi	Godhra ...	9	New School.
Sindhi	Mirpurkhas ...	5	One year course.

Thus there were 131 students in all. In addition to the above, 14 boys at the Bhil School near Dohad received a special short course of Agricultural instruction on the Muvalia Farm. These Schools are doing useful work. They are supervised by the Deputy Directors and by the Inspector of Agricultural Schools. The Loni and Devi Hosur Schools are doing well, and there is no difficulty in filling them to the extent of their capacity, though a few of the students usually fall out in the course of the year. The Godhra School has only made a start, and it is too early yet to say how it will do. In the Thana and Kolaba Districts the number of boys of the cultivating classes who have passed their 4th standard in the primary schools is not large, and it is only by making a considerable effort that we can secure students for our Jambul and Alibag Schools. In Sind the school is evidently not prospering, and its condition will receive attention during the present year.

18. Apart from the six schools in existence, six new ones were projected at Bagalkot, Karad, Niphad, Surat, Jalgaon and in Sind, but the present financial situation has brought the building programme to a temporary standstill. It is hoped that next year it will be possible to push on with the work of construction.

19. There appears to be a good opening for such schools at any rate in the more prosperous parts of the Deccan, and in such tracts there is every prospect of a number of such schools filling, but there are other parts where prospects are not so hopeful, though the idea of such schools meets with general approval. It was argued at the Provincial Board of Agriculture recently held in Poona that it was a mistake to provide board and lodging free at these Agricultural Schools, and that the cost involved was not justifiable. This, however, is the only condition on which we can at present secure students and even on such conditions it is not always easy to secure them. These schools cost about Rs. 10,000 a year each, and when the present programme of having one such school in each District is worked up to, the cost to Government it will be about Rs. 2 lakhs, a year. This is not an excessive price to pay for the end in view. It is true that on grounds of expense the number of such schools cannot be indefinitely multiplied, but when the time comes when it will be necessary to call a halt, it may be hoped that such education may have become sufficiently popular in some tracts to admit of the charging of fees for board and lodging.

CHAPTER V.

Agricultural Engineering.

20. The work of the Agricultural Engineer was continued on the same lines as in previous years. The boring work, for which there is much demand, has 127 successful bores to its credit as a result of the year's work.

21. In the matter of pumping plants a good deal of time was taken up in dealing with the aftermath of the pumping operations undertaken during the previous year to meet famine conditions. It is very uphill work for the Agricultural Engineer to ensure that the pumping plants that he erects for individuals shall be a success. The pump owner usually depends on the Agricultural Engineer for years together to run his plant and to be responsible for the smallest repairs. Even when the plant can be made a mechanical success, it is liable to be a financial failure, because it remains only half used, or because the cultivation is bad. I fear that we have not yet got to the stage when we can push such machinery amongst average cultivators simply on the ground that physical conditions are suitable. It is necessary in addition, that the man who owns the plant should be a man of enterprise, energy, and means. It is not easy to find this combination.

22. The trials of motor tractors for ploughing are given in Appendix L. They are not yet complete, but it will be seen that one type of tractor tried is promising. The trials, however, showed how many mechanical difficulties have to be faced in the use of such machines, and I have little hope that they can be brought into common use for a long time, though for exceptional conditions there may be a small opening for them in the comparatively near future.

23. The work of the Agricultural Engineer, especially in the boring branch, has out-grown his powers of supervision, and the time has come when either the work must be decentralised and the staff increased, or the volume of the work must be reduced. This matter has been reported to Government.

CHAPTER VI.

PROPAGANDA.

24. The following publications were issued during the past year, *viz.* :—

Bulletins.

No. 94.—The Sugarcane Borer and its control.

No. 95.—The cultivation of oranges and Allied Fruits in the Bombay Presidency.

No. 96.—Investigations into the manures of the salt lands of Sind.

No. 97.—Prickly pear as a Cattle Food.

No. 98.—Fruit culture as practised near Shikarpur, Sind.

No. 99.—The Rice cultivation in the Larkhana District (Sind) (Revised.)

No. 100.—Fodder crops of Western India.

No. 101.—Fruit culture in Palitana and Jamnagar.

No. 102.—Investigations of potato cultivation in Western India.

No. 103.—The Book of the Mango.

No. 104.—The Ganeshkhind Botanical Garden (Kirkee). Its genesis and development.

Leaflets (with vernacular versions).

No. 6 of 1919.—Cultivation of Jowar on Varkas Lands as a Kharif crop in the Konkan.

No. 7 of 1919.—The Marathi Agricultural School, Loni Kalbhor, District Poona.

No. 8 of 1919.—Supply of denaturalised salt for Agricultural purposes.

No. 1 of 1920.—Cultivation of Shalu Jowar on the rabi lands of the North Konkan.

No. 2 of 1920.—The growing of Onion for Seed.

No. 3 of 1920.—The Kanarese Agricultural School, Devi Hosur (Dharwar District).

No. 4 of 1920.—The cultivation of onions in Konkan.

Four vernacular agricultural journals were published, as usual, with the assistance of the Department.

25. Three agricultural shows of some size were held, and several fairly elaborate Farm demonstrations. A large number of village demonstrations and ploughing matches, &c., were organized all over the Presidency at which the advantages of improved implements, good seed, chemical manures and other matters were shown in actual practice in cultivators' fields.

I have the honour to be,

Sir,

Your most obedient Servant,

G. KEATINGE,

Director of Agriculture.

APPENDIX A.

Report of the Poona Agricultural College for the Year ending 1919-20.

1. This is the twelfth annual report of the Poona Agricultural College as a separate institution. The year has been characterized by a considerable increase in the number of students and a steady improvement in attendance and in the interest shown into the College duties.

We were greatly encouraged by the favour shown us by His Excellency Sir George Lloyd in presiding at our annual gathering and we appreciate the valuable words of advise and helpfulness.

The routine of our courses was interrupted by the special peace holidays. We feel that it has been a year of satisfactory progress in which both staff and students have worked together to make the year a success.

Buildings.

The temporary huts of the Deccan War Hospital still remain in the compound. Some of these are being utilized to accommodate the overflow of students from the hostel.

Optionals.

The graduating class elected optionals as follows:—

(*a*)	Agricultural Economics, Land Development and Intensive Farming.	23
(*b*)	Stock Breeding, Feeding and Management including Dairying.	7
(*c*)	Advanced Applied Botany ...	7
(*d*)	Advanced Agricultural Chemistry ...	0
(*e*)	Advanced Agricultural Entomology ...	0

It is perhaps too early to say with certainty whether or not at this stage in the development of the College, optional courses are really desirable. The graduates who have elected one of the optionals have not in the selection of posts followed the subject in which they were especially trained. Some of those electing Chemistry are working as agriculturists; those that specialized in Entomology accept posts in Botany as also has one who specialized in Chemistry and so on.

If a man follows his optional the field for service is considerably narrowed. This will always be the case until there is a wider demand for specialists than at present exists. In my opinion we have been a little precipitate in introducing electives. If the optionals were held in abeyance for the present it would permit of considerable economy of staff.

The special crop optionals have been continued in Optional A. This does not increase the work as the holding of large classes in practical work is impossible; it only means batching according to subjects instead of indescriminate batching.

The subjects and number selecting each are :—

(1) Sugarcane ...	3
(2) Rice ...	1
(3) Cotton ...	8
(4) Wheat ...	0
(5) Vegetables ...	2
(6) Narcotics ...	2
(7) Fruits ...	7

Optional A is not well balanced as far too large a part of the time is devoted to land development and economics.

After another year's experience a slight revision of the syllabus is highly desirable.

Examinations.

Of thirty-seven candidates who sat for the B.Ag. examination, one Mr. Taw Sone Teong received first class marks and 35 second class marks. Sixty-two men were sent up for the I.Ag. examination, 5 of which passed in the first class and 45 in the second class. At the College examination one student was granted the Diploma and three out of the five who appeared at the special passed. Of the 23 short class, five passed their annual tests and were given certificates.

College Staff.

The Principal's duties for the entire year have devolved upon the Professor of Agriculture. This has enabled him to give a more agricultural out-look to many of the other subjects than was possible before, but the petty administrative work detracts from teaching and research duties. An Assistant Principal or Dean who could do most of this is necessary if the most is to be made of the knowledge and experience of the Professor.

Mr. D. L. Sahasrabudhe has had charge of the Chemical Branch throughout the year.

Dr. W. Burns rejoined the College in August and had charge of the Botanical Branch even since.

Mr. S L. Ajrekar having been admitted to the Imperial Agricultural Service has gone to Nagpur as Mycologist. He was on leave after Dr. Burns' return in August until he went.

Mr. G. S. Kulkarni has acted as Assistant Professor of Mycology throughout the year.

Mr. S. S. Godbole, Assistant Professor of Physics and Mathematics, extended his leave for a year and Mr. J. P. Trivedi was deputed from the Engineering Department to take up the duties of this post which he has done with great satisfaction.

The present staff for teaching at the College is as below :—

Professor of Agriculture	...	J. B. Khight, M.Sc.
Professor of Botany	...	W. Burns, D.Sc.
Professor of Chemistry	...	D. L. Sahasrabudhe, L.Ag., B.Sc.
Assistant Professor of Agriculture	...	G. K. Ranade, L.Ag.
Assistant Professor of Botany	...	G. B. Patwardan, B.Sc.
Assistant Professor of Chemistry	...	N. V. Kanitkar, B.Ag., B.Sc.
Assistant Professor of Entomology	...	R. S. Kasargode, L.Ag.
Assistant Professor of Physics and Mathematics.		J. P. Trivedi, L.C.E.
Assistant Professor of Mycology	...	G. S. Kulkarni, M.Ag.
Assistant Professor of Dairying	...	H. G. Baluch, B.Ag.
Lecturer in Agriculture (Senior)	...	K. S. Kulkarni, B.Ag.
Lecturer in Agriculture (Junior)	...	H. M. Desai, B.Ag.
Lecturer in Veterinary Science	...	B. B. Joshi, G.B.V.C.
Lecturer in Chemistry	...	V. G. Patwardhan, B.Ag. B.Sc.
Lecturer in Entomology	...	V. G. Deshpande, B.Ag.
Demonstrator in Agriculture (Senior)	...	A. A. Vasavda, B.Ag.

Demonstrator in Agriculture (Junior)	...	G. P. Jambhekar, B.Ag.
Demonstrator in Dairying (Senior)	...	H. Ezekiel, B.Ag.
Demonstrator in Dairying (Junior)	...	S. M. Patel, B.Ag.
Domonstrator in Botany	...	T. R. Khadilkar, B.Ag.
Demonstrator in Horticulture	...	P. G. Dani, B.Ag.
Demonstrator in Engineering	...	S. R. Mujumdar.
Demonstrator in Veterinary Science	...	S. N. Nadgir, G.B.V.C.

Students.

The number of students of entering the class on July 1st was 89 a marked increase over last year's class which numbered 60. Appreciation of the value of our College and the course is spreading over India and even outside India and I feel certain that unless something is done to restrict admission we shall continue to grow until we become a very big College.

Details for the last seven years appear below :—

	1914	1915	1916	1917	1918	1919	1920 July.
First year students ...	36	35	54	58	61	60	89
Second year students ...	31	29	23	36	39	46	50
Third year students ...	27	31	35	23	35	38	48
Short-course students ...	22	27		(Not	held.)	23	12
Special and post graduate students.	1	2	3	7	2	3	4
Total ...	117	124	115	124	137	170	203

The statement below shows the localities from which our students are drawn :—

	1915	1916	1917	1918	1919	1920
Deccan ...	20	14	9	19	27	38
Southern Maratha Country and Konkan.	45	44	50	42	49	52
Gujarat ...	35	29	36	36	43	40
Sind ...	7	9	9	7	7	6
Assam ...	1	1	1	1	3	1
Central India ...	3	3	1	3		4
Nizam's Dominions ...	3	4	6	6	8	7
South India and Ceylon ...	7	6	5	13	16	23
Burma ...	1	2	5	6	7	19
United Provinces ...	2	3	2	2	1	2
Berar ...				1		
Bengal ...				1	4	7
Central Provinces ...					5	4
Total ...	124	115	124	137	170	203

It may be noted that 136 or about two-thirds come from the Presidency and they are divided fairly equally among the three divisions although the Southern Division has a slight lead but much less so than in previous years. It will be seen that the 67 outside students include men from most of the other Provinces of India and from Ceylon. The Burmese contingent is exceptionally high but this was by special arrangement to furnish the Burmese Department with men to start their own College and research work. We formerly performed a similar office for Nagpur.

They may be arranged according to communities as follows :—

	1915	1916	1917	1918	1919	1920
Brahmins ...	55	49	55	61	68	84
Marathas ...	5	4	4	6	16	20
Lingayats ...	4	3	2	2	1	5
Patidars (Gujarat) ...	3	4	10	13	12	7
Jains ...					6	4
Other Hindus ...					33	
Mahomedans ...	12	10	8	4	9	12
Parsis ...	15	15	12	7	5	5
Christians ...	1	1			7	16
Ceylon Students ...					6	7
Budhists ...					7	9
Others ...	29	29	33	44		34
Total ...	124	115	124	127	139	203

Brahmins no longer represent the majority on our rolls although no other single community furnishes as many.

Courses.

Two regular courses of instruction are offered at this College.

(1). A three years' course including a fairly exacting study of the sciences on which the agricultural practices are based such as Botany, Chemistry and Physics followed by a thorough drill in the practical application of these in the fields and gardens. The entrance requirements for candidates who are to go up for a degree certificate are that, either they must have satisfactorily passed the first year in an Arts College affiliated to the Bombay University or they must have passed an Intermediate Examination of an Indian University. A very limited number of students has in the past been admitted to this course who although not having exactly these qualifications have satisfied the Principal that their qualifications were equal to those required by the University. Such students are examined by the College and when they have completed their course satisfactorily, they receive a diploma signed by the Principal and countersigned by the Director of Agriculture.

The number admitted in the last six years is as below :—

1915	3	out of	35	equal to	8·6	per cent.
1916	12	„	„	54	„	„	22·2	„
1917	3	„	„	58	„	„	5·1	„
1918	8	„	„	61	„	„	13·1	„
1919	4	„	„	60	„	„	6·6	„
1920	7	„	„	89	„	„	7·8	„

As a rule students of the Presidency proper are not admitted under these special conditions.

(2) The other course is much less theoretical and is for such as wish to get a good practical working knowledge of improved agriculture but have not the time to take the full three years' course. It was opened to meet such a demand. From 1916 to 1918 this course was held in abeyance owing to lack of space. The only requisite for admission is to be able to understand English and agree to the rules of the College. The future of this course is still problematical. Vernacular classes in the various divisions of the Presidency carried on on similar lines would probably serve the same purpose but until such expansion is possible this course is filling a want at comparatively little extra cost.

We admit to our B.Ag. optional classes, passed B.Ags. who may have taken a different optional or other graduates whose previous work fits them to profit by these courses.

With the present size of the College it has been found impossible to accept any special students unless they can take up one of the existing courses *in toto*.

Scholarships.

Fifteen candidates who have passed the Previous Examination of the Bombay University or obtained the certificate from the Principal of an Arts College, which the Bombay University now accepts instead of that examination, are selected by the Director of Agriculture in consultation with the Principal of the College, for the scholarships offered by Government. These scholarships are given by preference to the sons of cultivators and are awarded for three years. The Director of Agriculture is empowered to give an additional year's scholarship to a limited number of Matriculates in an Arts College while studying for the First Arts.

The allotment by divisions of Government scholarships during the last seven years is as below :—

	1914	1915	1916	1917	1918	1919	1920
Deccan ...	2		3	3	3	5	7
Southern Maratha Country ...	4	5	5	7	2	4	4
Gujarat ...	4	2	2	3	6	3	1
Konkan ...	5	6	3	2	1	3	3

Library.

The library now numbers 10,680 volumes out of which 489 were added in 1919-20.

Other Institutions.

Besides the College proper, the following institutions are utilized for teaching :—

(1) Area attached to the Agricultural Branch. This consists of 185 acres. Every type of Agriculture and method of growing crops that can possibly be done is demonstrated on this area, great attention being given to all possible improvements. Many of our students are quite ignorant of the ordinary agricultural objects and methods so that considerable time is wasted in teaching what everyone should know from his own observation and experience. Quite half of the time is spent in giving the students this necessary work before the questions of improvement can be taken up. The teaching is as far as possible practical ; although Indian students have a predelection for lectures, and demonstrations rather than by learning through practice. It is very difficult to impress on staff and students the real meaning of practical work.

In the report of the Professor of Agriculture some of the yields grown on this area are given :—

(2) *Manjri Sugarcane Station.*—At this station the students electing optional A that specialise in sugarcane get an opportunity of carefully studying this important crop and in the station laboratory they get some practice in testing sugar content.

(3) *College Dairy.*—The Farm is of 353·14 acres including Manjri Kuran. Various sorts of fodders are grown here for demonstration. The herd numbers 134 buffaloes of three breeds and 121 cows of three breeds (including in each case young stock). Feeding, breeding and care of the herd and how to rear young stock form a feature of the teaching to those who elect optional B. The temporary dairy room has been remodelled and enlarged to meet the requirements of the large B batch and more dairy apparatus obtained so that this course is now on sound lines.

(4) *Karjat Rice Experimental Station.*—This station furnishes the opportunity for through training of students who specialize with this crop. It is only a few hours journey away and is the nearest place where improved methods with this crop can be demonstrated.

(5) The Cotton Farms of Surat and Dharwar are utilized for cotton teaching to supplement the cotton part of College Farm.

(6) *The Veterinary Dispensary.*—This serves as the practical demonstration for this subject. The students attend daily and assist in the treatment of animals.

The details of the working of the hospital appear in the statement below:—

Patients treated.	1917-18.	1918-19.	1919-20.
3. Total ...	2,039	2,051	1,986
1. In-patients ...	328	416	412
2. Out-patients ...	1,711	1,635	1,574
Daily Average Attendants.			
In-patients ...	14·58	14·99	19·37
Out-patients ...	21·20	23·00	17·07
Free patients ...	1,092	1,043	998
Paid patients ...	947	1,008	988
Agricultural animals ...	1,208	1,106	1,120
Non-Agricultural animals ...	831	1,245	366
Castration ...	10	12	3
Attendances on rinder-pest out-breaks...	48	16	24
Attendances on foot and mouth out-breaks.	25	14	3

(7) The Ganeshkhind Botanical Gardens have in the past been utilized for instruction in horticulture. The newly acquired land of Modibagh will now form the major instruction ground for the horticultural teaching and Ganeshkhind Botanical Gardens will become only supplementary so far as the College is concerned.

(8) The Herbarium and Botanical Laboratory of the Economic Botanist are available for the advanced students in Botany.

(9) The plant breeder has his office at the College and his breeding plots at Karjat College Farm and Manjri Farm stations are available for demonstration.

(10) The work going on in the Agricultural Chemist's Research Laboratory provides material for instruction to senior chemical students.

(11) The Agricultural Engineer's office, Work-shop and experimental wells are located at the College. Advantage is taken of this in teaching the mechanical part of the engineering in our course and the instruction in this subject, practical and theoretical, is carried on by one of his assistants.

(12) The Deputy Director of Agriculture in Animal Breeding is located at the College and he is of great help in teaching breeding.

(13) *College Gymkhana.*—The students maintain a gymkhana which carries on the following branches :—

(i) The publication of College Quarterly.

(ii) The holding of weekly lectures and debates.

(iii) The Tennis Branch maintains three courts which are used whenever there is an available hour.

(iv) The foot ball and hockey branch raised teams and played nine matches.

(v) A Cricket team was put in the field.

(vi) The Gymkhana maintains the students reading room where the following periodicals are taken :—

1. The Times of India.
2. The Bombay Chronicle.
3. The Bengali.
4. New India.
5. Indian Social Reformer.
6. Review of Reviews.
7. Modern Review.
8. Physical Culture.
9. Engineering College Magazine.
10. Fergusson College Magazine.
11. New Poona College Magazine.
12. Deccan College Magazine.
13. The Karnatak College Magazine.
14. St. Xavier College Magazine.
15. Sydneham College Magazine.
16. Central Hindu College Magazine.
17. Bauddhin College Magazine.
18. Gujarat College Magazine.
19. Baroda College Magazine.
20. D. J. Sindh College Magazine.
21. Elphiston College Magazine.
22. Wilson College Magazine.

23. Gynan Preacher.
24. The Journal of the Madras Agricultural Students' Association.
25. The Plant's Chronicle.
26. Aryan Education Society School Magazine.
27. Industry.
28. Prabhudha Bharat.
29. The Indian Scout.
30. The Marathi Teacher.
31. Science and Industry.
32. Khadayats Mitra.
33. School Magazine.
34. Navayuga.
35. The Times of India of Assam.
36. The Mysore Educational Journal.
37. Indian Scientific.
38. Chitramayajagat.
39. Davahtri.
40. Budhiprakash.
41. The Servant of India.
42. Vedic Magazine.
43. Quarter Journal.
44. Journal of the Indian Economic Society.
45. Gnanprakash.
46. The London Times.
47. The Looker on.
48. Vismi Sadi.

The exceedingly full time table of the College exercises prevents the students from taking advantages fully as they ought of the athletic features of the gymkhana. It is worth serious consideration whether we are not attempting far too much in our present course to secure satisfactory results and whether we are gaining anything in not giving more time to other features of College work.

The gross cost of working the College as was worked out last year is Rs. 96,291-15-1 which is not materially different from this year. The recoveries amount to Rs. 8,533 so that net cost per student is approximately Rs. 516.

There is a great need felt for more staff to strengthen the College to meet the increased size of the classes.

In my opinion the syllabus needs early re-organization.

APPENDIX B.

REPORT OF THE MARATHI AGRICULTURAL SCHOOL, LONI KALBHOR, FOR 1919-20.

This school as was mentioned in the last year's report was started in 1910 in Poona with its Farm and buildings in the close vicinity of the Poona Agricultural College. The object of the school is to provide for agricultural education through the medium of the vernaculars to sons of cultivators who are not able to send their children to obtain English education to be able to join higher institutions such as the Agricultural College. This school, it will be remembered, is an institution which gives free education with free boarding and lodging. It is intended to train the boys in farming on the latest lines possible, so that they should be able to improve their estates when they go back home.

The course of studies has remained one of two years. The conditions for admission in the school have also remained as before, *viz.*:—

(1) He should possess a certain amount of land.

(2) He must be between 14 and 17 years of age.

(3) He must have completed at least his Vernacular 4th standard.

Dr. Mann was in controlling and advisory charge of the school throughout the year. He has now left on leave and the school has gone under the Deputy Director of Agriculture, Central Division, since then. It is expected this change will place the school in still closer touch with the District workers and they will be able to help more than they could formerly.

Mr. K. S. Kulkarni, who had been the Head Master for the last three years, has now been transferred to the Poona Agricultural College since the latter part of May 1920 and Mr. R. D. Khandekar, B.Ag., has taken charge of the place since then. No other changes in the permanent staff have occurred during the year.

A very great want of a permanent teacher in carpentry and smithy has only recently been done away with by sanctioning the appointment of such a man for the school. A man has been appointed and it is expected this work will now go on very well.

The school continues to be in its permanent estate at Loni Kalbhor—a village about 10 miles from Poona, with a variety of irrigated farming, a Railway station close by thus affording ample facilities for study round about.

The drains round the main building have only been recently finished and thus a great part of the insanitary condition of the rooms has been removed. There is yet a corner which wants proper draining and a little bit raising up and this may be taken up very soon.

The silo has continued to give extreme satisfaction. A total weight of 26,018 lbs. of maiz was put in and a net fine silage weighing 19,272 lbs. was obtained. This works percentage of 74 per cent.

A fine pucca shed for fuel storage has been erected. The quarters of the fieldman have been made more comfortable.

A special seed and tool store of a better and more convenient type was proposed during the year under report. The general plan was approved of by Dr. Mann, the Director of Agriculture, but the work could not be started owing to want of funds. It is hoped that funds will be available soon for this another very great urgent want.

The museum has been made more and more permanent in nature and useful additions to class apparatus, maps, &c., have been made.

The school library has been under improvement and could be made really much more efficient if funds are available.

The school was so far doing only training of students. But since the year under report it has been used as a training school for prospective agricultural school Head Masters. During the year under report Mr. R. B. Nimbalkar, B.Ag., was under training from July to the end of the school year. After his training he has been appointed Head Master of the Veshvi School, Alibag.

Mr. M. A. Ulvi, B.Ag., Head Master of the Mirpurkhas Agricultural School, was at the school for some weeks for getting an insight into the working and teaching.

The Bengal Department of Agriculture sent Mr. P. Vishwas for training as Head Master of their new school at Dacca.

Special quarters for men under training have now been sanctioned and it is expected they will be taken in hand very soon.

The poultry section has been enlarged by the addition of a pen of white leg horn birds. Three hens and a cock were purchased for Rs. 80 and now at the end of May we have nine cockrels and 14 pullets. Some of the pullets have started layings. Cocks are being sold at Rs. 10 each, cockrels at Rs. 8 each and eggs for hatching at Rs. 8 a dozen. People of the cultivating class have not got much appreciation for special breed and most of our stock is being sold at present in higher circle.

Farm.—As reported last year the Farm land have continued to improve. To the end of May 1920 almost the whole area has been levelled and laid into terraces of quarter acre area. These small pieces require still more levelling which will be taken up gradually. Addition of humus in the shape of san green manure has no doubt been very beneficial in improving the physical nature of the soil. Levelling has reduced to a minimum the difficulties of irrigation. All this with timely tillage has meant a very great deal for the soil, as a result of which we have now quite decent crops. The lucerne area of ½ acre has during 6 months given an average outturn of lbs. 2,287 per cutting first year which speaks for itself as an excellent crop on the kind of land we have. The crop of N. R. cotton also yielded very well indeed with a weight of lbs. 828 per acre. The last two pickings were all beaten down by January rains or else it is estimated that yield would have gone much higher. An excellent crop of brinjals in hot weather was grown giving a gross yield of lbs. 5,563 fetching Rs. 195 in all per ¼ acre. All other crops did show a very marked improvement.

A lowest bit of land to the West of the school buildings which, so far refused to grow any crop, has now been growing a very decent crop of plaintains and about 6 months old as they are now, they are really very promising. The old variety of fruit garden has been removed and the area is now ready for receiving "Musumbi." It is intended to make this a purely Musumbi garden and get it up to be an ideal one for the people round about.

The rains were not at all anything sufficient during both the Kharif and Rabi season and hence all the cropping had to be done under irrigation. An area of about 20 acres to be cropped with the help of students with irrigated crop throughout the year is really very hard and trying.

Boys.—The boys at present in the school are 43 in all and are derived from the following districts:—

[*For statement see next page.*

1920-21.

District.	2nd year.			1st year.			Remarks.
	Brahmin.	Maratha.	Others.	Brahmin.	Maratha.	Others.	
Poona ...				2			
Sholapur ...	3			2			
Nagar ...		1		1		1 Goldsmith.	
Nasik ...	1				2	1 Carpenter.	
East Khandesh ...	1	6		1	2	3 Kunbi.	
West Khandesh ...	1						
Belgaum ...				1			
Ratnagiri ...				1			
Kolhapur ...	2			1			
Berar ...	1	1			1	1 Rajput.	
Kurundwad ...	1			2			
Baroda ...				1			
Nizam State ...				1			
Faltan State ...						1 Mali.	
Total ...	10	8		13	5	7	Total 43

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC

Arranged according to caste they stand as follows :—

Brahmins ... 23

Non-brahmins ... 20

The number of applications amounts to more than 60 this year and we had a fair chance of selection. We are still receiving enquiries for additional admissions but they have to be asked to apply next year.

Help from outside :—

Name of the District Local Board.	Amount. Rs. a. p.
Belgaum ...	72 0 0
West Khandesh ...	144 0 0
East Khandesh ...	144 0 0
Nasik ...	216 0 0
Ahmednagar ...	288 0 0
Sholapur ...	216 0 0
Kolaba ...	72 0 0
Total ...	1,152 0 0

Course of Instruction.—The curriculum has remained as before. A small pamphlet has been printed during this year giving all general information about the school, its management, course of studies in detail, &c. A copy is attached.

The Saturday mornings were utilized for trips to various neighbouring and short distance Farms, the Agricultural College, the Government Botanical gardens, the Veterinary Hospital attached to the College, &c. The annual Christmas tour this year was taken in January and study of conditions of soil and crops, &c., was made at different centres. This year the students visited the same places as mentioned in the last year's report, *viz.*, Nasik, Kherwadi, Jalgaon, Surat, Amalsad, Navsari, Bassein, Bombay and Jambhul; Belapur and Utran in Khandesh were additional tours. It was very useful and interesting no doubt.

Course of Studies.—The same as mentioned in the pamphlet attached.

Health of the Estate.—Save the small students' world illnesses, the general health was good. One student caught cholera but was narrowly saved from death. The drinking water supply has yet been the same. A boring in search of better underground water has been sanctioned and is expected to take place soon.

In April there were the Annual Examinations. Messrs. G. K. Ranade, L.Ag., Assistant Professor of Agriculture, N. V. Kanitkar, B.Sc., B.Ag., Assistant Professor of Chemistry and K. S. Kulkarni, Head Master of the school, acted as examiners. The result of the examination was satisfactory. Very great stress was laid on the practical side.

Following are the results:—

	Appeared.	Passed.
Final year ...	16	13
First year ...	22	17
Total ...	38	30

The examiners have remarked as follows:—

"The students of both the classes showed a fairly good grasp of the subjects of Arithmetic, Marathi and the Geography. They seemed to know their subject fairly well but many of them were not able to express it properly. They do not seem to take advantage of the library which the school possesses. If this is done, I think, it would improve their general knowledge and enable them to express their thoughts better."

21st August 1920.

N. V. KANITKAR,
Examiner,
Assistant Professor of Chemistry.

"There were 22 students in the first year and 16 in the second year. Out of these 20 from the first year and 15 from the second year passed in Agriculture."

"On the whole I found that the students did excellent in their examinations. Their answers in theoretical agriculture and their practical work including the handling and working of implements were very satisfactory."

G. K. RANADE,
Examiner,
Assistant Professor of Agriculture.

The number of passed students now reaches 130 nearly. As promised last year re-union of past students was held at a special meeting where a good deal of interesting discussion took place. Several difficulties were solved. Mr. K. M. Pawar, Inspector of Agricultural Schools, presided. The past students were advised to stick on to their own farms with courage.

The social gathering was a very great success indeed. Sports and articles prepared by students for competetion included a great variety and showed really some fact. Various prizes were distributed. In addition to the usual prizes on such occasion there were some more which need special mention.

Dr. Mann offered a series of prizes for sports held on the Peace Celebration day.

Mr. Rasal of Ahmednagar gave a special prize for a special essay on the Christmas tour and the lessons learnt from it. Other sympathisers also gave suitable prizes, among these being Messrs. K. B. Bhagwat, B.Ag., S. S. Gaikwad, an enterprising young landlord of Fursangi. This year Shrimant Raje Shambhusing of Malegaon presided. Dr. Mann was also present. There was also a number of local and outside visitors. The President advised students on general lines and asked them to work hard and diligently at the Agricultural industry which is after all the most important one of all and is the back bone of India.

Balance Sheet of the Marathi Agricultural School, Loni Kalbhor, for the year 1919-20.

RECEIPTS.				EXPENDITURE.			
Received from	Rs.	a.	p.	Spent for	Rs.	a.	p.
Poona Treasury ...	14,564	13	8	Boarding expenses ...	4,498	6	9
Office of the Director of Agriculture.	350	0	0	Conservancy charges ...	199	15	4
Sale proceeds of the Farm and miscellaneous recoveries of the school.	966	4	2	Cultivation charges ...	838	15	10
				Draining and levelling ...	490	2	0
				Fruit and vegetable garden.	225	5	6
				Upkeep of live stock ...	970	0	0
Depot implement hire, &c...	72	0	0	Oil engine and pump ...	142	0	0
District Local Board, Belgaum.	156	14	0	Purchase of live stock ...	670	12	3
				Miscellaneous expenses ...	620	0	4
Do. West Khandesh.	144	0	0	Implements ...	200	0	0
Do. do. ...	144	0	0	Furniture ...	20	0	0
Do. Nasik ...	216	0	0	Books ...	20	0	0
Do. Ahmednagar ...	288	0	0	Manure ...	500	0	0
Do. Sholapur ...	216	0	0	Poultry farming ...	725	0	0
Do. Kolaba ...	72	0	0	Tour of the students ...	151	8	0
				Workshop ...	349	15	10
				Petty constructions ...	306	1	0
				Irrigation charges ...	75	13	2
Total ...	17,189	15	10				
				Total, contingent charges ...	11,004	0	0
				Pay of the establishment, Personal.	2,079	5	2
				Do. School staff ...	1,048	8	0
				Travelling allowance of the school staff.	733	0	6
				Postage ...	50	0	0
				Remitted to the Poona Treasury.	2,275	2	2
				Grand Total ...	17,189	15	

R. D. KHANDEKAR,
Head Master,
Vernacular Agricultural School, Loni.

APPENDIX C.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, GUJARAT DIVISION, IN 1919-20.

I was in charge of this division throughout the year. Mr. G. N. Desai continued to work as Divisional Superintendent of Agriculture, N. D., and Mr. K. D. Naik continued as Cotton Superintendent on the temporary establishment, for the whole year. There was practically no change in the superior staff of the Farms.

The following Agricultural Stations with the subordinate staff at present exist in this division :—

No.	Name of the Farm.	Area.	Staff on the Farm.
		A. g.	
1	Surat ...	292-15 (156 -0 arable.)	1 Superintendent (Graduate). 2 Graduate Fieldmen. 4 Non-graduate Fieldmen.
2	Nadiad ...	44-0 (37-0 arable.)	1 Overseer (Non-graduate). 1 Non-graduate Fieldman.
3	Dohad ...	57-22	1 Superintendent (Graduate). 1 Graduate Fieldman. 1 Non-graduate Fieldman.
4	Broach ...	24-19	Managed by the District Agricultural Overseer, Broach, under supervision of the Divisional Superintendent of Agriculture, N. D.
5	Sunev Plot ...	4- 0	Do. do.
6	Amalsad Sugarcane Farm ...	19-12 (11-25 arable.)	1 Overseer (Non-graduate). Under supervision of the D. S., N. D.
7	Nadiad Agricultural Association Plot.	2-0	Do. do.

In addition to the above, there are two special men maintained for this division : *viz.*, (1) Cotton Supervisor and (2) Entomological Assistant.

The following statement shows the total strength of the superior staff working under the Deputy Director of Agriculture in this division :—

No.	Name of the Post.	Gazetted or Non-gazetted.
1	Divisional Superintendent of Agriculture, N. D.	Gazetted.
3	Superintendents of Farms ...	Non-gazetted.
1	Cotton Supervisor ...	Do.
1	Entomological Assistant ...	Do.
6	District Agricultural Overseers and Graduate Fieldmen.	Do.
9	Non-graduate Fieldmen on Farms and in Districts.	Do.
3	Graduate under training ...	Do.
1	Head Master, Vernacular Agricultural School, Godhra.	
	Temporary.	
1	Cotton Superintendent ...	Gazetted.
4	Graduate Assistants ...	Non-gazetted.

Besides these, there are four permanent Kamgars and several Depot-keepers and ploughmen engaged for demonstrational purposes, &c.

In addition to the above, the institution of the Vernacular Agricultural School at Godhra commenced working during the year under report.

The summary of the work is divided into the following five parts :—

I.—Cotton work—

(*a*) By the Temporary Establishment.

(*b*) By the Cotton Supervisor, in cotton breeding, &c.

II.—Work on Agricultural Stations.

III.—Work in the District.

IV —Work of giving Vernacular agricultural education at Ambali School and in the Bhil School at Dohad.

V.—The work of the Entomological Assistant.

I.—Cotton.

In connection with this crop, two lines of work were chalked out by Dr. Mann in a meeting with the other officers and staff working in cotton in the division, *viz.*, (*A*) work to be carried on by the temporary establishment of the Cotton Superintendent with the staff under him; and (*B*) work to be done by the Cotton Supervisor.

(*A*) *Work of the Temporary Establishment.*

As finally settled, this staff has to supervise and control an area of 6,000 acres from the time the seed is issued for sowing till the resulting produce is marketed and the total quantity of seed secured for general distribution next year.

The seed for these 6,000 acres is to be supplied every year from the Athwa group—a group of six villages round about the Farm which serves the purpose of our registered seed growers or even more, as they are fully accustomed to the Farm practices for the last 10 or 12 years and carry out our instructions to the full, not only in keeping the cotton pure, but also to a very great extent as regards cultivation and marketing.

This Athwa group, in turn, gets new improved seed annually from the Farm produce. The Farm, in turn, has to be supplied annually with *fresh* new seed for the whole area under cotton on the Farm by the Cotton Supervisor from his unit selected stock of this particular strain.

In addition to the above, the important duty of this staff has to attend to three other minor duties, *viz.*, (1) The propagandistic work of discouraging the cultivators from growing Goghari or other inferior cottons by explaining to them the disadvantages and risks they undergo by so doing wherever they go or by issuing leaflets on this subject and distributing them. (2) Whenever possible and when they can get time, they have also to go over the tract and find out and report the percentage of Goghari mixture in the tract. The knowledge of this fact alone discourages the cultivators from growing Goghari and inferior cottons. (3) The work of studying the conditions of cultivation, habits of growth and other peculiarities of the cotton plant as seen under different soils and conditions.

As stated in the last year's report on page 31, one Cotton Superintendent Mr. K. D. Naik assisted by two graduate assistants was put on this work from 1st June 1919. Lbs. 80,355¼ of seed of Selection I-A was secured with great difficulty and care, and distributed in 5 different groups of villages, the area sown being in all 5,972 acres. This area was rogued very closely and supervised by the cotton staff from the beginning till the harvesting and marketing was complete.

At the time of marketing and distributing the seed from the current season it was found necessary to fill up the remaining two posts of graduate assistants kept in abeyance till their services were badly required.

The season for the germination and growth of cotton turned out to be very favourable till the middle of November and the crop was expected to give a bumper yield. But due to the unusual and unexpected rains of November 1919 and very heavy rains of January 1920 with continuous cloudy weather the cotton prospects were marred to a greater or less extent according to the early sown and advanced state of the crop or late sown and not much advanced state of the crop. Hence the three groups of villages growing our seed in Jalalpore and Bardoli Talukas of the Surat District suffered more from these rains on account of the advanced state of the crop than the groups in Chorasi Taluka sown late.

Collection of Cotton and its Final Disposal.—During the whole year as required from time to time eight meetings of the Surat Cotton Committee were held to consider the important questions of—

(1) how best to discourage and lessen the area under Goghari mixture and the settling of the groups of villages for the distribution of seed;

(2) to discuss the cotton policy as regards the (*a*) disposal of cotton, (*b*) securing of funds for purchasing the seed by requesting the Director of Agriculture to move Government for the same; and for (*c*) extending the area of operations up to the southern bank of the Nerbuda river.

(3) and (4) to discuss and finally settle about the best method of selling cotton (lint).

Dr. Mann, the Acting Director of Agriculture, tried to be present in the 2nd, 3rd and 4th meetings; whereas, the Collector, Mr. Kabraji, with his Mamlatdars of Chorasi, Bardoli and Jalalpore Talukas and the Hon'ble Mr. Purshotamdas Thakordas took the trouble of attending the third and the most important meeting.

The remaining four meetings of the Cotton Committee were held from 27th March 1920 to 8th May 1920 for the auction sale of cotton. The subjoined table gives the details of the different auction sales effected.

Date of Sale.	Name of the Group.	Quantity of lint auctioned in Khandies.	Name of the purchaser.	Per Khandi.			Remarks.
				Rate obtained.	Local rate.	Premium obtained.	
27-3-20	Athwa and Mohni.	120	Sheth Ghelabhai P. Desai.	625	550	75	
,,	Supa and Bardoli.	118	Messrs. Ralli Bros. & Co.	635	573	62	
10-4-20	Athwa and Mohni.	120	Mr. Jamsedji N. Kapadia.	652	616	36	
,,	Vijalpore 1027 A. L. F.	20	Messrs. Narandas Rajaram & Co.	671	641¼	30	
,,	Supa ...	35	Do.	666	641¼	25	
,,	Sisodra ...	35	Do.	663	641¼	22	
24-4-20	Athwa and Mohni.	30	Sheth Jamnadas Chunilal.	666	635	31	
,,	Bardoli ...	20	Do.	675	643	32	
8-5-20	Supa and Sisodra.	55	Do.	686	643	43	

From the above, it will be seen that the persons named above, the members of the Cotton Committee, and all the Officers of the Department working in cotton took very keen interest in making the scheme a success. Thanks of the Department are due to the members of the Cotton Committee and other merchants who gave very valuable help in this respect.

The auction system seems to be interesting and attractive both to the cultivators and the traders. Had it not been for the abnormal rains and the cotton stainted a little, the premiums realised would have been still greater and the produce relished more by the trade.

The annexed table gives the total quantity of cotton collected and sold with its financial aspects, &c.

[*For statement see next page.*

Serial No.	Name of the group.	Area in acres.	Total seed cotton received.	Total seed cotton received.	Total quantity of lint obtained.	Actual quantity of seed.	Rate per candy.	Value of lint realized.	Value of seed.	Total value.	Ginning charges, &c.	Net value.	Reduced rate per bhar.	Local rate per bhar.	P. C. increase over local rate.	Ginning.	Remarks.
			Bh. mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.					
1	Athwa																
	Lot I		209 14 30	5,030 30	1,689 26	3,241 0	625	50,050 8 0	4,537 6 5	54,587 14 5	1,598 13 3	52,989 1 2	252/12	207	22·1	62·5	
					1,475 24		652	45,614 13 6									
					88 10		666	2,787 3 9									
					90 31		601	2,587 14 5									
	Lot II		198 16 22	4,768 22	1,654 25	3,020 20		50,989 15 8	4,027 5 4	55,017 5 0	1,518 5 0	53,499 0 0	269/4	215	25·2	60·5	
	Lot III		44 9 30	1,065 30	331 30	712 0	666	10,472 5 2	949 5 4	11,421 10 6	339 8 0	11,082 2 6	249/8	230	8·4	67·5	
	Total	1,266	452 17 2	10,865 2	3,676 1	6,973 20		1,11,512 12 10	9,514 1 1	1,21,026 13 11	3,456 10 3	1,17,570 3 8					
2	Mohni				829 3		625	24,558 12 0									
	Lot I		147 3 25	3,531 25	310 17	2,321 0	653	9,608 0 0	3,249 6 5	37,416 2 5	1,320 8 3	36,095 10 2	245/8	207	18·6	65·08	
					1,139 20			34,166 12 0									
					1,050 25		652	32,481 1 9									
					127 11		666	4,028 15 5									
					142 22		601	4,060 3 3									
	Lot II		166 1 20	3,985 20	1,320 18	2,585 0		40,570 4 5	3,446 10 8	44,016 15 1	1,518 6 3	42,498 8 10	255/12	215	18·9	63·4	
	Lot III		10 20 5	260 5	82 19	173 0	666	2,602 10 0	230 10 8	2,833 4 8	105 15 0	2,727 5 8	252/	230	9·5	66·2	
	Total	921	324 1 10	7,777 10	2,542 17	5,089 0		77,339 10 5	6,926 11 9	84,266 6 2	2,944 13 6	81,321 8 8					
3	Vijalpore	270	58 6 35	1,398 25	431 6	967 29	671	13,722 12 0	1,451 9 5	15,174 5 5	500 0 9	14,674 4 8	253/	230	10·0	68·1	
4	Bardoli																
	Lot I		233 15 29	5,607 29	1,779 24	3,710 0	635	53,586 6 0	5,194 0 0	58,780 6 0	1,852 0 9	56,928 5 3	243/10	211	15·4	66·5	
							661										
							635										
							625										
	Lot II		170 11 9	4,091 9	1,285 38	2,720 0		39,989 0 0	3,626 10 9	43,615 10 9	1,355 12 0	42,259 14 9	247/14	220	12·8	66·6	
							675										
							625										
	Lot III		70 4 26	1,684 26	517 35	1,149 0		16,347 4 0	1,503 4 5	17,850 8 5	556 9 3	17,293 15 2	245/14	235 200	4·6 22·9	68·5	
	Total	1,865	474 7 24	11,383 24	3,583 17	7,579 0		1,09,922 10 0	10,323 15 2	1,20,246 9 2	3,764 6 0	16,482 3 2					
5	Sisodra																
	Lot I		96 5 23	2,309 23	722 10	1,540 0	663	22,717 12 0	2,156 0 0	24,873 12 0	760 0 9	24,113 11 3	250/8	225	11·33	67	
	Lot II		61 10 19	1,474 19	436 19	1,007 0	686	14,206 14 3	1,342 0 0	15,568 14 3	411 8 6	15,137 5 9	246/8	230	7·1	70·8	
	Total	948	157 16 2	3,784 2	1,159 29	2,547 0		36,924 12 3	3,498 0 0	40,442 10 3	1,171 9 3	39,251 1 0					
6	Supa																
	Lot I		72 7 13	1,735 13	575 14¼	1,125 0	635	17,337 8 9	1,575 0 0	18,912 8 9	544 4 3	18,368 4 0	254/4	220	15·5	63·3	
					739 13¾		666	23,371 8 0									
					757 26¼		686	24,661 2 9									
	Lot II		205 12 37	4,932 37	1,497 0	3,333 0		48,032 10 9	4,444 0 0	52,476 10 9	2,512 10 0	50,964 0 9	248/	230	7·8	69·2	
	Total	702	277 20 10	6,668 10	2,072 14¼	4,458 0		65,370 3 6	6,019 0 0	71,389 3 6	2,056 14 3	69,332 5 3					
	Grand Total	5,972	1,744 21 3	41,877 31	13,464 4½	27,164 9		4,14,792 13 0	37,733 5 5	4,52,526 2 5	13,903 12 0	4,38,631 10 5					

From the above, it will be seen that though the crop was damaged by heavy rains and bad opening, the percentage of increase is good except in some few cases where it was badly damaged or where it was due to the combination of the buying merchants. On the whole the cultivators were very much satisfied as could be seen from the rush for securing our improved seed for sowing during 1920-21.

Seed distribution for the year 1920-21.—The Government on being moved by the Director as stated above were pleased to sanction a grant of one lakh of Rupees for the purchase of seed for distribution in the current season, and all the resulting seed lbs. 1,086,569 from all the produce handled by the Department was purchased at market rate and lbs. 1,026,569 were distributed amongst cultivators at cost price after reserving about lbs. 60,000 for resowings and emergencies.

As the season was very late, it would not have been possible to distribute such a large quantity of seed in such a short time, had it not been for the causes mentioned below :—

(1) Prompt action taken in opening 10 depots at different centres for the convenience of the cultivators by appointing weigh clerks and depot keepers only temporarily for two months or so.

(2) Great assistance given by the members of the Cotton Committee in helping the Department by purchasing seed from the Department and distributing it among their own clienteles.

(3) Distribution of a leaflet issued by the Committee under the signature of the Cotton Superintendent, showing the advantages of sowing improved seed supplied by the Agricultural Department.

(4) Good premiums realised by cultivators who grew our seed.

(5) Difficulty experienced by cultivators in disposing of their produce grown from mixed seed even at a lower rate.

(6) Lastly, help from the Revenue authorities when applied for.

As per settled plan, the whole area that will be sown this season with improved seed will not be supervised by the Department, but the area of 6,000 acres of the last year's group will be under the departmental control for all purposes for securing seed for general distribution in 1921-22, with the only exception that instead of 6,000 acres being under Selection I-A, 4,000 will be under this strain and 2,000 acres in the Navasari tract will be under 1,027 A.L.F. for distribution in that tract as it is superior in staple to Selection I-A and in great demand on that side both by cultivators and traders.

Copies of the opinions of the persons who purchased our cotton are attached herewith,* to show how far they are liked by the traders.

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* Copy of Letter No. R. C. V., dated 15th March 1920 from Messrs. Volkart Bros., Bombay :—

"We beg to own receipt of your two Letters No. 770 of the 10th instant and without number of the 13th. The two samples of lint mach-ginned from the Kapas grown under the supervision of the Agricultural Department have also been received over the week-end and have just been examined by us.

"Compared with the quality of such samples as we have so far seen of this year's crop in the Surat, Bardoli and Navsari Districts the sample sent by you is of whiter colour and practically free from any stains, whilst the samples of the ordinary cotton from these districts show this year (at any rate up to now) quite a considerable amount of stain and partly dull colour. Your samples also show silkier and more regular staple of better length and considerably less fluffy fibre than the cotton offered in the market shows this season. The prices in the Surat District are ruling rather high and we regret that on this level we are not in a position to effect any purchases even for Cotton equal to your samples, but we would say that compared with the other samples we have seen of Surat, Bardoli and Navsari the value of your cotton ought to be for better class and for better staple at least 1d. more per lb., which on basis of an Exchange of 2 s. 6d. we work out to be about Rs. 25 per candy."

Copy of Letter, dated 26th June 1920, from Mr. Manilal Tribhovandas, Agent, Narandas Rajaram & Co., Surat, to the Cotton Superintendent, Surat :—

"We are in receipt of your letter of 26th instant. In reply to it we have great pleasure to write that the work undertaken by the Agricultural Department in the direction of growing Farm Kapas is highly commendable. We think the lint from this Kapas is good stapled and silky and along with it of a fair ginning percentage. The fact that the farmers are growing this Farm cotton-seed and Kapas is ginned under special supervision of the staff of the Agricultural Department, is a sufficient proof of cotton remaining pure and unmixed with low cotton, which so generally happens now on this side. We think that the careful distribution of these cotton seeds to various farmers in particular village grouped together will do well enough to improve quality, &c.

"We have written to Mills for their opinions on this and we shall let you know when we hear from them."

The cotton staff was totally new to the work, and the undersigned had to assist them in almost all important matters and in dealing with both merchants and cultivators. In the actual ginning and marketing season he had to remain longer at headquarters. But the Cotton Superintendent and his staff worked very hard, and it is expected they will soon pick up their work.

Goghari Cotton Mixture.—This Goghari mixture in the best cotton tract of Surat District is alarmingly increasing in spite of all the Departmental activities to counteract its spread. The Cotton Superintendent and his staff whenever they could be spared are asked to survey the different parts of the Surat District in order to ascertain the per cent. mixture of Goghari. The Cotton Superintendent's report forwarded with this office No. 927, dated 23rd March 1920, shows the extent to which it has entered into the heart of the best cotton tract of Navsari. Another report was submitted by me with my office No. 1556, dated 7th May 1920, showing the extent to which the traders and cultivators tried to import inferior cotton from Broach District and even North Gujarat from Kaira and Panchmahals. The margin of Rs. 100 to 150 or even more between the selling price of Broach Good at Broach and the one at Surat enticed them to import Kapas both by carts and rail from very long distances. The enticement was so great that I doubt some of the members of the Surat Cotton Committee even may have purchased the inferior lot. Under these circumstances, the measures adopted by the Department for checking or eliminating Goghari mixture will not bear any fruit unless and until they are supported by legislation prohibiting the importation of inferior cotton (Kapas) into a tract growing superior cotton either by rail or road or by boat, and by licensing the ginneries. But even this will not be very effective as the importation of seed cannot be prohibited and the process of eliminating Goghari seed will take years unless and until a strong policy is adopted and pursued for some years.

Copy of Letter, dated 30th June 1920 from Mr. Ghelabhai Pragjibhai, Gin-owner and Cotton Merchant, Navsari :—

"We are in due receipt of your letter, dated 26th June 1920. In response, we have great pleasure to address you as under :—

"(1) The lint resulting from the cotton-seed that you distributed in Navsari district last year is very good, while the type you distributed in Surat District is quite fit for that portion. The 1027 A.L.F. is the best of the lot and I think that this type will suit well to Navsari tract.

"(2) I specially recommend that the seed should be distributed on a large scale without leaving any village, nay, even a cultivator.

"(3) In my humble opinion, the system of selling raw cotton by auction should prove a better one than the one adopted of auctioning the lint adopted during the year by the Agricultural Department. This will avoid a great risk on the part of the Department.

"(4) I also specially recommend that the import of short stapled cotton by rail or road should be prohibited in the next season.

"(5) I appreciate the work done by the Cotton Superintendent this year. If the same procedure is followed in future, the producers as well as the buyers of Cotton will be benefited."

Copy of Letter dated 28th June 1920 from Mr. Jamshedji Navrosji Kapadia, Kapadia Pressing & Ginning Co., and Cotton Commission Agent :—

"We are in due receipt of your letter of 26th June 1920. In reply to it, we give our opinion as under :—

"(1) Cotton supplied by you is better in quality and feel than the local cotton.

"(2) Your seed appears larger and cleaner than the local one.

"(3) The seed distributed for the next season was not sufficient to cover the whole tract. Many farmers had to go back without seed as it was not in stock. The supply was less than the demand. We therefore request the Department to watch the seed distributed and keep the outturn pure as far as possible.

"(4) We are sorry to state that the question of mixing the cotton that is increasing day by day, is not taken up seriously by the Government. Low cotton is imported in the district by carts and rail in wagons ; this should immediately be stopped, otherwise the cotton of the whole district will be deteriorated. The question of prohibition of outside cotton should be handled side by side with the introduction of pure seed."

Copy of Letter, dated 27th June 1920, from Mr. Dahyabhai Sundarji, Gin-owner & Cotton Merchant, Vedchha.

"As desired by you in your letter No. 431, dated 26th June, I submit my opinion on the introduction of pure and improved seed in Surat District as under :—

"(1) The district is in bad necessity of having pure seed for sowing purposes. It is worth while for the Government and the Native States to spare no pains and also money to secure pure seed. The seed which is being distributed by the Bombay Agricultural Department is an ideal one for the tract, north of the river Purna, in my humble opinion. The seed may systematically be distributed in this tract. The Agricultural Department ought to be helped by the trade and the Revenue Department in this respect.

"(2) I myself have established a ginning factory since long at Vedchha, the heart of the proper Navsari and Billimora tract. I am rather ambitious to get still superior staple for this tract. In my opinion the Hybrid 1027 A.L.F. must be suitable for Navsari-Billimora tract. We have in that tract a very congenial climate for fine staple, but at any rate, the local staple though superior in quality is very poor in ginning. This and similar other problems connected with cotton crop on this side are required to be solved. May I venture, therefore, to request the Agricultural Department to start a cotton Farm on some suitable site in this tract. I do not know the requirements of a Farm, but am willing to help the Department in securing the land if necessary between Vedchha and Abrama of the Jalalpur Taluka on reasonable terms."

This may be somewhat on the following lines :—

(1) Legislation as stated above.

(2) A cordon to be placed on a line running east to west to be decided by the Agricultural and Revenue Departments commencing from the extreme south of the Surat District, prohibiting all imports of Kapas and asking the ryots of the tract protected by the cordon to grow seed supplied by the Department.

(3) Any cultivator found growing any other inferior cotton or a mixture cotton should be penalised. The prosecution should only be allowed when certified by the Deputy Director of Agriculture and the Secretary of the Bombay Cotton Board. A few cases will be enough to set an example to all the rest; not only that, but they will be forced to keep pure seed or take it from the Department. This cordon should be kept for that much area for which the Agricultural Department can supply seed.

(4) This cordon should be moved towards the north year after year, so that in the course of about eight years the whole tract of Surat and Broach can be purified.

(5) All Native States may be asked to adopt the same policy.

(6) Many of the stringent rules may be relaxed after that period.

Unless and until some such measures are adopted by Government, it is doubted very much whether any tangible results could be achieved by milder measures now contemplated.

(B) Cotton Breeding Work done by the Cotton Supervisor and his staff.

On the Surat Farm, for the first time, the seed propagated from the unit selected plants of all the improved strains was tested with the Surati Deshi seed produced on the same Farm. It is equally gratifying to note here that the Cotton Breeding Staff has been able to supply enough seed propagated from the unit selected plant of Selection I-A and 1027 A. L. F., to sow the whole of the Farm area under cotton this season, so that within two seasons more, it will be possible to distribute the seed of this pure strain to about 80 to 100 thousand acres. This will also enable us to distinguish the plants of Selection I-A and 1027 A. L. F. from the Deshi after the formation of the bolls.

The work of the unit selection will be continued to keep these strains pure and supply enough seed for sowing the whole of the Farm area every year with fresh further improved seed of the superior strain intended to be distributed in the district on a large scale, and if possible, to eliminate inferior ancestry (if there be any).

Taking into account the yield, the higher ginning percentage and the valuation of lint, Selection I-A will give extra profits of nearly Rs. 4 per acre, as will be seen from the following statement :—

Statement showing Comparison of Selection I-A with other Cottons.

Variety of cotton and locality.	Yield of Kapas per acre.	Ginning percentage.	Yield of lint per acre.	Valuations per Khandi of lbs. 784 by Messrs. Tata and Sons.
Deshi (Farm seed grown on Surat Farm from best strain).	354	31·6	111·8	530
Selection I-A, Long Boll (Surat Farm) ...	342	35·9	122·7	520
1027 A. L. F.. do. ...	359	32·2	115·5	625
Do. (grown at Vijalpur, Jalalpur Taluka).		31·2		560
Navsari Deshi (sample from Mr. Tamboli, Agent to Messrs. Tata and Sons).		31·6		525

From the above it will be seen that:—

(1) Cotton grown at or round about Surat fetches about Rs. 20 less than that grown at Navsari.

(2) Taking Rs. 525 as the basis of valuation for Navsari cotton, the relative value of Surat cotton will be Rs. 505, and thus Selection I-A which is valued at Rs. 520 is superior to the local Surat cotton.

(3) The valuations of 1027 A. L. F. grown on the Surat Farm and at Vijalpur near Navsari differ by Rs. 65 perhaps due to acclimatisation of the seed on the Surat Farm. When 1027 A. L. F. was grown on the Sisodra plot and acclimatised for 3 or 4 years from 1912-13 to 1915-16, it was valued equal to the same cross grown on the Surat Farm. This indicates the necessity of carrying on the selection work on 1027 A. L. F. in the Navsari tract for which it is intended (*vide* Annual Report of 1915, page 15).

If we compare the ginning percentage and spinning tests, of our two special strains, taken in 1919-20 to those of 1912-13, from the following table we find that there is, with very little difference, a general improvement in the number of counts, tension in lbs. and ginning percentage. It will further be seen that though the ginning percentage of Selection I-A has increased to 2·9 within the period, yet the staple is well maintained.

Table showing the improvement in the selected strains of Farm cotton during the past 8 years.

Variety of Cotton.	Number of counts in 1912-13 to 1919-20.		Tension in lbs. in 1912-13 to 1919-20.		Ginning percentage in 1912-13 to 1919-20.	
Surati-Broach ...	22	23·25	60	61½	32·5	31·6
Selection I-A, Long Boll ...	22	23·25	59	58½	*33·0	35·9
Do. Cylindrical ...		23·25		59		34·5
1027 A. L. F. ...	22	23·25	61	61½	33·1	32·2

* The sample of Selection I-A in 1912-13 was of mass selected seed.

In order to secure a cross superior to any yet discovered several crosses between the pure bred strains of Goghari E 5 (with a very high ginning percentage) and 1027 A.L.F. and Selection I-A of good staple have been made.

Many morphological and growth characters are studied in the existing strains with a view to find out the best typical plant best suited for Southern Gujarat.

Unit selection will be continued in one strain of Goghari which has got good staple combined with high ginning percentage.

The whole scientific work done in Goghari cotton up till now is being published with the final conclusions arrived at.

In order to discover a strain having high ginning percentage and very good staple, *unit* selection was started in Broach Deshi with eight selected plants.

Surat Selection I-A is compared with Broach Deshi to see if it keeps up its superiority over the local Deshi.

As there is no Government Farm in the Ahmedabad District, the unit selection work in Lalio and Wagad cottons is being conducted at Broach. 11 strains of Wagad and 5 of Lalio have been retained.

The following statement shows the monetary results of different strains of Goghari in comparison with Selection I-A tested on the Broach Farm. The results are worked from the valuations and ginning percentage of lint. The valuations of other samples not tested are also put in for the comparison of staple.

Name of cotton variety.	Yield of lint per acre.	* Valuations per Khandi of 784 lbs.	Comparative gross profits per acre.
	lbs.	Rs.	Rs.
Goghari B_{21} ...	55·4	300	25·45
Do. C_{22} ...	54·6	300	23·26
Do. D_{26} ...	41·6	280	19·50
Selection I-A ...	43·8	550	35·59
Goghari E_2 ...		490	
Purified Broach Deshi...		510	

* These are received from Messrs. Tata & Sons, on the following basis of valuation on 22nd May 1920:—

	Rs.
Fine Broach as available in the market ...	400
Fine Broach ...	500
Fine Bengal ...	295
Fine Khandesh	290

It will be interesting to observe that the relative prices of short stapled cottons have dwindled down to such an extent that if the present ration continues, there is every possibility of establishing a long stapled cotton in Broach District in spite of the high ginning percentage of Goghari. All the Goghari strains except E_2 are now valued almost equal to Khandesh cotton. It is E_2 strain in which long staple and high ginning percentage are combined and further trials are being made on this.

Similarly, the local cotton from Baroda and the 2 Goghari strains from the same place were kindly valued by Messrs. Tata & Sons. Lalio and Wagad cottons from Broach Farm were also valued on the 10th July 1920. The results summarised in the table below:—

Variety of cotton.	* Valuation per Khandi of 784 lbs. by Messrs. Tata & Sons.
	Rs.
Lalio from Broach ...	430
Wagad round boll, Broach ...	450
Do. long do. ...	440
Local cotton from Baroda ...	225
Goghari B_3 do. ...	225
Do. E_5 do. ...	225

* Basis of Valuation:—
Broach fine Rs. 480.
Dhollera fine Rs. 520.
Viramgam fine Rs. 525.
Khandesh fine Rs. 250.

From the statement it will be seen that the Local cotton from Baroda is valued equal to Goghari strains, thus indicating that the Local cotton is now pure Goghari. Due to this reason it is now valued even less than Khandesh.

II.—Work done on Agricultural Stations.

(1) *Surat Agricultural Station.*

Seed Selection and Plant Breeding.

Cotton.—Out of the two selected strains of cotton, Selection I-A reported last year to have been kept up in preference to Selection II and Deshi Broach due to its high yield, ginning percentage and fine staple, was continued during the year 1919-20.

The total area under cotton was 83 acres and 12 gunthas, sown largely with this variety, which yielded on an average 471 lbs. per acre, even though it was damaged by the late rains of January, causing dropping down of flowers and tender bolls.

Thus the Farm crop was better than the crops of the cultivators in point of yield, staple and ginning. All the seed secured from this area by separately ginning on the Farm, was distributed amongst the cultivators of the Athwa group of six villages, supplying them the first rate seed. The total amount of this seed was 21,334 lbs., sufficient for 2,666 acres.

The cultivators were advised to dibble the seed in squares at the rate of 6 lbs. per acre, to economise the seed and to give it a through cultivation necessary to obtain higher yields. The Farm lint fetched Rs. 75 more per Khandi, even though it was auctioned off along with the cultivators' lot; otherwise it was expected to bring in a premium of Rs. 100.

For the purpose of demonstrating, this variety was sown in comparison with others and it showed its superiority over the Bazar seed by 6·8 per cent. or 33 lbs. per acre, on an average of the last four years.

Jowar.—The selection work on three important varieties of the tract, *viz.*, (1) Perio, (2) Chapti and (3) Sholapuri, is showing good results. The Farm selected seed showed its superiority over Bazar seed, in the case of Perio, by 31·2% or 326 lbs. more in grain, or Rs. 17 or 19% in net profit, per acre; while in the case of Chapti the increase was 74 lbs. or 8% and the net profit was Rs. 5 more per acre or 6·3% and Sholapuri gave 21% increase in yield and 20% in net profit or 196 lbs. or Rs. 16 more, per acre, over the Bazar seed.

The demand for Farm grown seed is increasing day by day and almost all the seed is largely distributed amongst the cultivators.

Manurial.—The manurial experiments of the last season were continued and they confirmed the results obtained in the previous years, *viz.*, that the periodical application of night soil and poudrette enhances the yield of jowar and cotton to a great degree (*vide* Statement I attached).

Similarly, top-dressing jowar with commercial artificials increased the yield by 11 to 14%, but due to high prices of the manures, the cost of application becomes prohibitive. The new rotation in which groundnut largely enters has proved better and more economical than the local cotton-jowar rotation (*vide* Statement II).

Similarly, the two year cotton rotation with San and fallow-in-strips has shown its superiority over the local rotation (*vide* Statement III).

Cultural Experiments.—Cultural experiments of dibbling *vs.* drilling gave appreciable results in favour of dibbling and besides maintaining an ideal tilth and cleanliness made the operations easy and convenient at any time. The practice is found faring better on dirtier fields of cultivators, and is now being largely adopted by good cultivators. This method has been adopted by the cultivators of nearly the whole district and on the Farm it is mostly generalised as far as practicable (*vide* Statement IV).

STATEMENT No. I.

Average figures showing Yield of Cotton and Jowar from 1911-12 to 1919-20.

Treatment.		1911-12.		1912-13.		1913-14.		1914-15.		1915-16.		1916-17.		1917-18.		1918-19.		1919-20.		Average of 9 years in cotton and 7 years in jowar.			More or less per cent.	More or less lbs. per acre.
		P. P.	B. P.	P. P.	B. P.	P. P.	B. P.	P. P.	B. P.	P. P.	B. P.	P. P.	B. P.	P. P.	B. P.	P. P.	B. P.	P. P.	B. P.		P. P.	B. P.		
Poudrette	C	22 0	1,644 0	806 0	2,309 0	592 8	1,392 0	272 4	471 0	363 12	727 0	48 12	390 0	806 0	2,115 0	515 4	756 0	459 0	918 0	C 431 11	1,191 5		+ 16 %	+59
												Til & Tur.		Til & Tur.										
	J	581 0	10,968 0	618 0	5,982 0	1,713 12	5,337 0	1,483 0	2,961 0	1,199 4	2,226 0	Failed.		Til Tur 300	2,250 0	J	Green. 13,104 0	1,300 8	3,573 0	J 985 1	6,350 2		− 6 %	−61
Night-soil	C	477 0	2,742 0	1,177 8	2,370 0	921 0	1,770 0	379 8	615 0	366 12	735 0	165 0	447 0	501 0	1,536 0	563 4	864 0	572 4	1,144 0	C 569 4	1,358 2		+ 52·5%	+197
												Til & Tur.		Til & Tur.										
	J	2,554 0	15,755 0	810 0	9,213 0	1,749 0	6,342 0	2,104 0	2,802 0	1,468 8	1,723 0	Til 60 12 Tur 204 0	240 0 1,044 0	Til Tur 425	2,625 0	J 378 0	4,432 0	1,254	3 681 0	J 1,473 14	6,276 11		+ 40 %	+437
No Manure	C	181 8	1,434 0	432 0	1,206 0	569 4	1,302 0	393 0	594 0	394 14	790 0	1[illegible] 8	363 0	404 0	1,275 0	534 0	615 0	343 0	[illegible] 6 0	C 372 13	918 5		Standard.	Standard.
												Til & Tur.		Til & Tur.										
	J	684 0	14,172 0	964 8	3,747 0	1,261 8	3,864 0	988 0	1,638 0	1 629 0	1,758 0	Til 63 12 Tur 141 0	Til. 234 0 Tur. 300 0	Til Tur 215	1,950 0	J 331 8	3,426 0	1,170 0	3,453 0	J 1,046 14	4,579 11		Standard.	Standard.

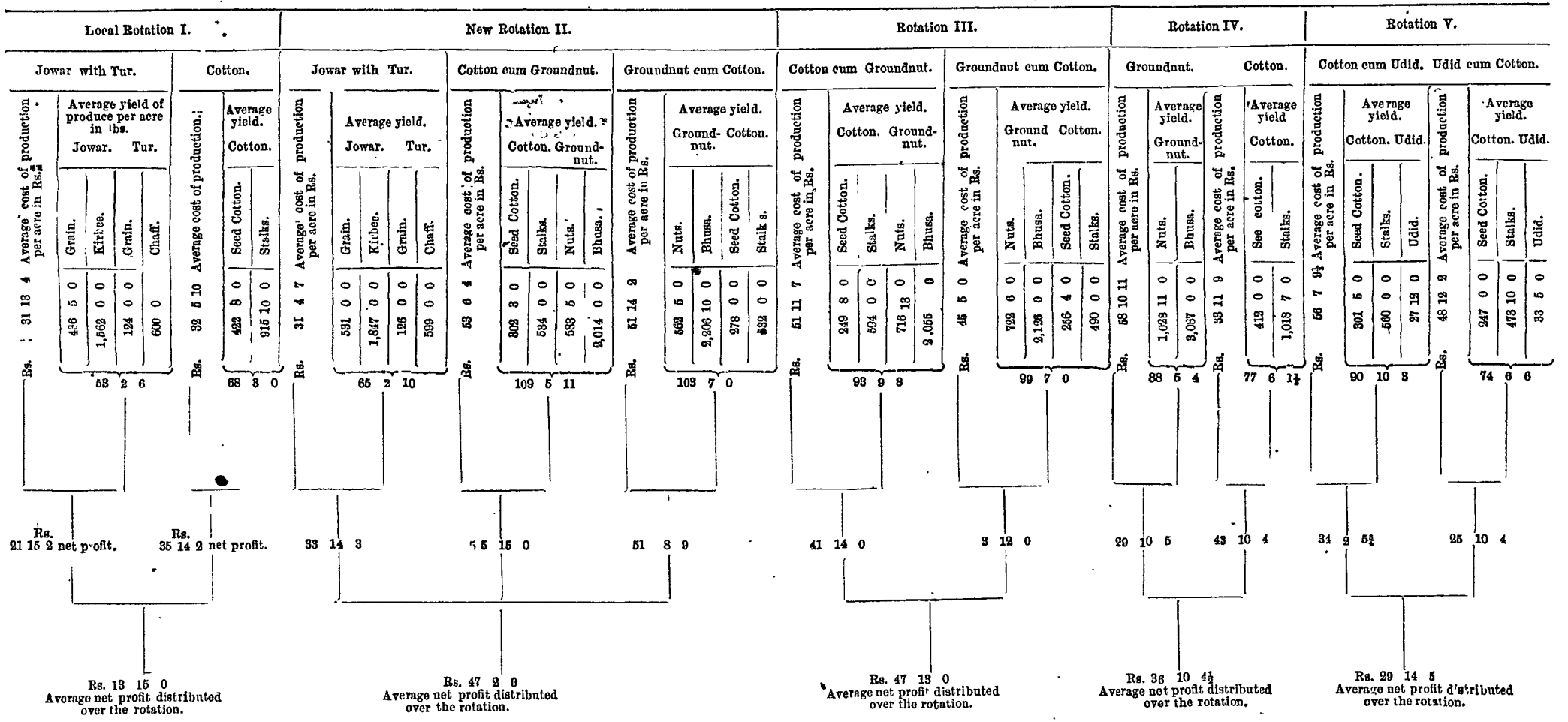
P. P.=Principal Product. B. P.=Bye-Product.

In years of drought "Poudrette" plot has considerably suffered and failed, but "Night-soil" plot has uniformly yielded better in all seasons over the "Non-manure" plot, and the "Poudrette" plot. There is no trouble with this manure (*i.e.* Night-soil) even in dry years. The night-soil, and Poudrette manure has given 50 per cent. more fodder in case of jowar besides the increase shown in grains.

STATEMENT No. II.

Rotational Experiments of Groundnut and Cotton.

Average figures of the last nine years from 1911-12 to 1919-20.


Local Rotation I.
Jowar with Tur.
Average cost of production per acre in Rs.
Rs. 31 13 4
Average yield of produce per acre in lbs.
Jowar. Tur.
Grain. Kirbee. Grain. Chaff.
436 5 0 | 1,562 0 0 | 124 0 0 | 600 0
53 2 6
Cotton.
Average cost of production.
Rs. 33 5 10
Average yield.
Cotton.
Seed Cotton. Stalks.
422 8 0 | 915 10 0
68 3 0
New Rotation II.
Jowar with Tur.
Average cost of production per acre in Rs.
Rs. 31 4 7
Average yield.
Jowar. Tur.
Grain. Kirbee. Grain. Chaff.
531 0 0 | 1,847 0 0 | 126 0 0 | 599 0 0
65 2 10
Cotton cum Groundnut.
Average cost of production per acre in Rs.
Rs. 53 6 4
Average yield.
Cotton. Groundnut.
Seed Cotton. Stalks. Nuts. Bhuss.
302 3 0 | 594 0 0 | 553 5 0 | 2,014 0 0
109 5 11
Groundnut cum Cotton.
Average cost of production per acre in Rs.
Rs. 61 14 2
Average yield.
Groundnut. Cotton.
Nuts. Bhuss. Seed Cotton. Stalks.
562 5 0 | 2,206 10 0 | 278 0 0 | 532 0 0
103 7 0
Rotation III.
Cotton cum Groundnut.
Average cost of production per acre in Rs.
Rs. 51 11 7
Average yield.
Cotton. Groundnut.
Seed Cotton. Stalks. Nuts. Bhuss.
249 8 0 | 594 0 0 | 716 13 0 | 2,055 0
93 9 8
Groundnut cum Cotton.
Average cost of production per acre in Rs.
Rs. 45 5 0
Average yield.
Ground nut. Cotton.
Nuts. Bhuss. Seed Cotton. Stalks.
723 6 0 | 2,126 0 0 | 256 4 0 | 490 0 0
99 7 0
Rotation IV.
Groundnut.
Average cost of production per acre in Rs.
Rs. 58 10 11
Average yield.
Groundnut.
Nuts. Bhuss.
1,028 11 0 | 3,037 0 0
88 5 4
Cotton.
Average cost of production per acre in Rs.
Rs. 33 11 9
Average yield
Cotton.
See cotton. Stalks.
412 0 0 | 1,018 7 0
77 6 1½
Rotation V.
Cotton cum Udid. Udid cum Cotton.
Average cost of production per acre in Rs.
Rs. 56 7 9½
Average yield.
Cotton. Udid.
Seed Cotton. Stalks. Udid.
301 5 0 | 500 0 0 | 27 12 0
90 10 3
Average cost of production per acre in Rs.
Rs. 48 12 2
Average yield.
Cotton. Udid.
Seed Cotton. Stalks. Udid.
247 0 0 | 473 10 0 | 33 5 0
74 6 6
Rs. 21 15 2 net profit.
Rs. 35 14 2 net profit.
33 14 3
55 15 0
51 8 9
41 14 0
3 12 0
29 10 5
43 10 4
31 2 5½
25 10 4
Rs. 13 15 0
Average net profit distributed over the rotation.
Rs. 47 2 0
Average net profit distributed over the rotation.
Rs. 47 13 0
Average net profit distributed over the rotation.
Rs. 36 10 4½
Average net profit distributed over the rotation.
Rs. 29 14 5
Average net profit distributed over the rotation.

(1) From the above it will be seen that the net profits per acre in the four new systems are Rs. 47-2-0, Rs. 47-13-0, Rs. 36-10-4½ and Rs. 29-14-5, respectively, as compared to Rs. 13-15-0 in the first local two years system. Thus the new rotations have shown much better results over the local rotations.

(2) These experiments are expected to give better results on the Goradu tracts.

(3) The above results were obtained from isolated areas but the system would be more paying if tried on a larger scale, as damage from birds, jackals, &c., would be minimised in that case.

(4) Jowar crop following two years Cotton Cum Groundnut rotation has increased in yield by lbs. 95 in grain and lbs. 285 in Kirbee per acres, *i.e.*, 23 per cent. in grain and 18 per cent. in Kirbee than in the local rotation.

(5) In conclusion it is further hoped that with an addition of a good dose of Farm Yard manure in the new rotation the results will be still better.

STATEMENT No. III.

Plot No.	Crop.	1917-18. P. P.	1917-18. B. P.	1917-18. Value.	1917-18. Cost.	1918-19. Crop.	1918-19. P. P.	1918-19. B. P.	1918-19. Value.	1918-19. Cost.	Average. Value.	Average. Cost.	Average. Net profit.	Remarks.
				Rs. a. p.	Rs. a. p.				Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
I	Cotton and San in strips ...	377-12	725-0	112 10 2½	60 1 7	San and cotton in strips ...	269-8	491-0	73 6 11	38 3 4	93 0 6¼	49 2 5½	43 14 1½	
II	Perio Jowar and ...	J 588-8	1,268-0	77 6 3	53 2 1	Cotton ...	428-8	986-0	117 8 3	61 15 1½	97 7 3	57 8 7½	39 14 7½	
	Pulses ...	Tur 95-8	778-8											
III	Cotton and fallow in strips ...	348-12	695-0	106 5 10½	41 1 4	Fallow and cotton in strips.	335-8	578-0	91 4 6½	40 10 5	98 13 2½	40 13 10½	57 15 4	
IV	Fallow ...				38 11 3	Cotton ...	423-0	1,222-0	116 15 ½	42 0 11	58 7 6½	40 6 1	18 1 5½	

From the above it will be seen that the net profits in case of cotton with San and fallow strips are more than in the case of local rotation. This experiment is tried for only three years and requires further continuance for a longer period before any definite results can be achieved.

P. P.=Principal Product.

B. P.=Bye-Product.

STATEMENT No. IV.

Dibbling vs. *Drilling Experiment.*

Treatment. Per acre.	Crop.	1916-17. P. P.	1916-17. B. P.	1916-17. value.	1916-17. Cost.	1917-18. P. P.	1917-18. B. P.	1917-18. Value.	1917-18. Cost.	1918-19. P. P.	1918-19. B. P.	1918-19. Value.	1918-19. Cost.	1919-20. P. P.	1919-20. B. P.	1919-20. Value.	1919-20. Cost.	Average. P. P.	Average. B. P.	Average. Value.	Average. Cost.	Net. Profit.
				Rs. a. p.	Rs. a. p.			Rs. a. p.	Rs. a. p.			Rs. a. p.	Rs. a. p.			Rs. a. p.	Rs. a. p.			Rs. a. p.	Rs. a. p.	Rs. a. p.
Dibbled 3×3 ...	Cotton..	567-9	673-0	99 7 8	18 13 8	444-8	967	135 12 3	52 13 2	436	625	118 2 6	54 14 1½	472-5	944-10	120 6 6	57 3 6	480-1½	802-6½	118 7 3	45 15 1½	72 8 1½
Drilled 2 feet apart..	Do. ...	500-5	705	87 12 ½	15 5 0	406-10	816-12	140 0 8	53 10 5	377	571	102 4 6	5 15 9	390	780	98 15 2	55 1 7	418-7½	718-3	107 4 1	44 0 2½	63 3 10½
Cotton was dibbled in this plot in previous year.	Jowar...	977-2	2,075	61 8 3	13 12 9	732-4	1,715	9,013 0 0	52 5 0	501-12	2,394	127 7 3	53 8 0	1,070	3,160-8	108 11 4	56 12 11	820-4½	2,336-2	97 1 11½	44 1 8	53 0 3½
Cotton was dribbed in the previous year.	Do. ...	1032-5	2,296-10	66 4 2	13 12 9	678-8	1,872	88 11 6	52 5 0	608-0	2,689-8	148 5 3	54 8 9	1,019	2,6-3	103 3 11	56 12 11	834-7½	2,335-4½	96 10 2½	44 5 10½	52 4 4½

The dibbling system has given lbs. 62 or 15 per cent. more seed cotton per acre on an average of four years, but in the case of jowar no difference is noticeable. It has to be further tested.

Observations.—The practice of dibbling has the following advantages over drilling—

(1) The dibbling could be done at the convenience of the cultivator at any time before the rains set in or could be done when the soil is little more wet to work implements.

(2) It is found that the dibbled plants do not suffer so much from heavy rains as drilled plants.

(3) The weeding, &c., is done by cross interculture more by bullock labour than by manual labour.

(4) In a scarcity year, dibbled cotton does much better than drilled one due to even spacing and good interculturing treatment.

Special experiments with ridge and furrow cultivation combined with good manuring are undertaken for obtaining the heaviest yields of the staple crops, *viz.*, cotton and jowar; the results of which will be reported next year.

Fodder Experiments.—In the Athwa area we are continuing to grow fodder jowar since five years on about six acres. A piece of land measuring one acre was sown with American varieties of jowars for fodder purposes, *viz.*, Standard Milo, Black Hull Kafir, Black Hull Kaolin and Feterita. Out of these Standard Milo gave nearly lbs. 30,000 of green stuff per acre and would have fared better, had it not been for the attack of Chilo simplex.

The Sundhia jowar fodder was tried in $2\frac{3}{4}$ acres, which gave two cuttings of best green fodder weighing lbs. 30,000 per acre under natural dry cultivation.

In the year under report, ensilage was made as usual in two pacca silos. One was filled with green jowar and the other was filled with green grass. The percentage of useful silage to green weight was 65·75 in the latter as compared with 50·7 per cent. of last year due to careful packing and necessary repairs in the silo. The cost of lbs. 1,000 of good silage in this case has come to Rs. 14 as compared with Rs. 15 of last year, even though green grass was carted from a distance of two miles from our Farm. The other silo filled with jowar is still being fed to cattle which indicates every possibility of being superior in all respects to the results of last year. This stuff was fed to the dairy and work cattle of the Farm with good results for nearly $4\frac{1}{2}$ months.

The Breeding Herd.—A herd of Kankreji animals has been maintained for breeding good animals for milk and stud purposes. The strength of the herd on 1st April 1920 was 87 of all classes as against 102 of last year as per table (No. V) below. The total milk yield from 35 cows was lbs. 78,495 ozs. 12, as against lbs. 84,277 ozs. 12 from 38 cows of last year.

STATEMENT No. V.

Statement showing the Strength of the Breeding Herd on the Surat Farm Dairy on 31st March 1920.

Serial No.	Description.	Strength on 31st March 1919.	Purchased during 1919-20.	Born in 1919-20.	Transferred from bull or she-calves.	Total of Cols. 4 to 6.	Total of Cols. 3 and 7.	Died in 1919-20.	Sold in 1919-20.	Transferred or otherwise disposed off.	Total of Cols. 9 to 11.	Balance on hand on 31st March 1920.
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Stud bulls ...	2			2	2	4		1	1	2	2
2	Cows ...	33			2	2	35		8		8	27
3	Heifers ...	17			8	8	25	1	8	2	11	14
4	Bull-calves ...	17		17		17	34	4	10	2	16	18
5	She-calves ...	33		14		14	47	4	9	8	21	26
	Total ...	102		31	12	43	145	9	36	13	58	87

Out of 35 cows one heifer has calved during March 1920 and three cows were sold nearly two months after parturition. Practically, therefore, the yield is from 32 cows. This also included three poor milkers which were sold off. Excluding all these, there were 29 cows in milk which gave on an average lbs. 2,636 per annum as against lbs. 2,589·9 of last year.

It will be interesting to note that the cow Parjani shown in the last report to have yielded lbs. 4,255 in her ninth lactation, has given also good results this year, even though she is getting old, by giving lbs. 1,831 in five months and 20 days.

The Farm bred cow Budhi whose son is selected as stud bull for the Dairy has given an average of lbs. 3,239 of milk per annum in 7 years after 1st calving.

During the year under report there were 31 births and 9 deaths, as compared with 10 and 5, respectively, of last year.

During the year under report 36 animals were sold fetching Rs. 4,100. Out of these 20 animals comprising of cows, heifers and young calves of our rejected lot were sold for Rs. 3,150, and fetched an average price of Rs. 165 per head. 14 were sent to Sind for a nominal price of Rs. 700 for the Sind Farm, and one cow was sold to Nandod State for Rs. 250 with her calf. The demand for our animals has grown more than we could supply.

(2) *Dohad Farm.*

The selection of wheat work was continued. As soon as Mr. Chibber, the Plant Breeding Expert, takes charge of this work, it will be handed over to him.

A cross between Wajia and Popatia seems to be very promising in three ways; *viz.*, (1) the yield is more as compared with the rest on a field scale; (2) it is almost rust-resisting and (3) the straw seems to be strong and does not lodge. The grain of this cross differs from both the parents.

On brown soils Pusa 4 has done better; while on black soils Pusa 12 has done better in point of yield.

Cotton.—Due to fear of frost, Neglectum cottons are tried on this Farm, in comparison to Cambodia and Selection I-A. The following statement compares the results :—

Name of Cotton Variety.	Yield of seed-cotton in lbs. per acre.	Ginning per-centage.
1. N. R. C. ...	652½	42·6
2. Sindewahi Cross ...	550	38·3
3. N. R. Black-seeded	582	36·1
4. N. R. Ordinary ...	440	39·1
5. Cambodia ...	267½	33·2
6. Selection I-A	Failed.	

On account of wet year on a retentive soil like that of Dohad, the Neglectums did not do well this season; and the last two failed on account of frost. The Neglectums will be tried for 2 or 3 years more to arrive at definite conclusions; while Cambodia and Selection I-A or Broach Deshi will be dropped as they are late ones and get badly damaged by frost.

Maize.—From the beginning of the Farm an experiment to compare the results of drilling *vs.* sowing maize after a plough is being conducted. The results are given below.

Comparative Statement of Drill vs. *Plough Method of sowing Maize.*

Year.	Crop.	Drill method.		Ordinary plough method.		Increase or Decrease due to drill over plough method.	Remarks.
		Plot No.	Outturn per acre of maize in lbs	Plot No.	Outturn per acre of maize in lbs.		
				Average of			
1907-08	Maize.	42	2,874	30 plots.	1,808	+1,066	First year of cropping and of the Farm.
1908-09	,,	42-44A	268	42-44B	196	+72	Irregular rainfall.
1909-10	,,	,,	2,507	,,	2,084	+423	In drilled plots germination thin.
1910-11	,,	40 F.G.	2,144	40 D.E.	1,812	+332	In both the cases land was previously tilled.
1911-12	,,	23 to 28A	873¾	23 to 28B	751¼	+122¾	One acre area under each treatment dry year.
1912-13	,,	42-44B	2,086	42-44A	2,198	−122	Distance between the rows not being same; results not reliable; wet year.
1913-14	,,	53	684	53	697	−13	Sown in alternate rows by drill and plough.
1914-15	,,	53	1,026	53	1,006	−60	Do. do.
1915-16	,,	13-15B	1,093	13-15A	772	+321	Dry year for less retentive soil.
1916-17	,,	16-18B	1,112	16-18A	445	+667	Ordinarily wet year.
1917-18	,,	6-9, 54A	433	6-9, 54B	603	−170	Very wet year.
1918-19	,,	7	1,088	6	947	+141	Very dry year.
1919-20	,,	7	816	6	814	+2	Very wet year.
Average ...			1,308		1,093	+215	

It will be interesting to note that drilling has proved to be better in nine out of 13 seasons, and also better on an average of all the seasons. The years in which it could not do better were wet years, and so good interculturing was not possible.

Cotton Rotation.—It was argued by many that cotton will not be a paying crop on double cropped soils without irrigation facilities. An experiment was started since 1915-16 to see which rotation does better. The following statement will speak for itself in favour of the cotton rotation :—

Rotation without Irrigation, i.e., where irrigation facilities do not exist in black soils.

Year.	Local Rotation. Crop.	Outturn per acre in lbs. Principal product.	Bye-product.	Value.	Cost of production.	Profit or Loss.	New Rotation. Crop.	Outturn per acre in lbs. Principal product.	Bye-product.	Value of produce.	Cost of production.	Profit or Loss.
				Rs. a. p.	Rs. a. p.	Rs. a. p.				Rs. a. p.	Rs. a. p.	Rs. a. p.
1915-16	Maize ...	1,268		47 9 0	21 8 1	+30 9 1	Maize ...	577		21 2 2	25 6 1	−4 2 10
	Gram ...	422	390	17 7 8	13 6 8		Gram ...	148	633	7 13 11	7 12 10	
	Fallow ...					−21 2 1	Cotton ...	659	1,022	61 12 6	23 1 1	+38 11 5
	Wheat ...	143	320	8 2 5	29 4 6		Nil ...					
1916-17	Maize ...	2,077	3,793	55 11 5	23 11 3	+48 13 2	Maize ...	1,455	2,850	39 4 0	23 11 3	+35 2 6
	Gram ...	715	935	28 4 3	11 7 3		Gram ...	785	1,045	31 1 0	11 7 3	
	Fallow ...					+31 14 9	Cotton ...	1,191		153 7 5	18 4 0	+135 3 5
	Wheat ...	841	1,629	50 8 10	18 10 1		Nil ...					
1917-18	Maize ...	1,305	3,200	52 15 7	34 11 5	+25 13 1	Maize ...	1,119	2,800	45 7 5	41 14 6	+14 9 3
	Gram ...	721	822	35 10 6	23 1 7		Gram ...	792	894	31 1 11	28 1 7	
	Fallow ...					+2 5 3	Cotton ...	222½	915	41 11 6	36 13 3	+4 14 3
	Wheat ...	544	1,236	43 4 4	40 15 1		Nil ...					
1918-19		Famine		year								
1919-20	Maize ...	891	2,130	36 10 9	44 14 8	−22 3 1	Maize ...	686	1,944	36 4 0	45 12 6	−24 5 5
	Gram ...	357	624	23 11 0	37 10 2		Gram ...	353	602	27 7 9	33 4 8	
	Fallow ...						Cotton ...	985½		173 7 5	35 0 3	+137 7 2
	Wheat ...		Failed.				Nil ...					
	Average	profit	of 4	years		11 5 4						42 2 9

(3) *Broach Farm.*

The Farm is mainly intended for varietal, cultural and breeding work in cottons. The work in Lalio and Wagad will be transferred to a Farm or plot as soon as one is opened in North Gujarat. The work in Goghari is only limited to preserving some pure strains with very high ginning percentage for crossing with other types of cotton with superior staple but low ginning, in order to secure a strain with good staple and high ginning percentage required for the tract. Every effort is now being made to find out a suitable variety of Broach type by selection and crossing.

(4) *Amalsad Farm.*

As stated on page 29 of the last year's report the same experiments to check red-rot in sugarcane were continued on the Amalsad Farm. Instead of nine of last year, 10 varieties were tried, *viz.*, (1) Malbari, (2) Pundya, (3) Stripped Mauritius, (4) Bangdya, (5) Bassein Red, (6) J. 247, (7) Manjav, (8) Red Mauritius, (9) Khadya and (10) Khajuria. Out of all these, Red and Stripped Mauritius, J. 247 and Manjav, though harder than Malbari or Pundya and consequently less susceptible to red rot, seem to be promising as compared with other hard local varieties similarly red-rot resistant, on account of their vigorous growth and high yield. Surrounding cultivators were very keen to secure seed even by paying Rs. 5 to 10 more per 1,000 seed canes over the local rate of Malbari which is generally higher by about Rs. 10 than that of other varieties. The results are tabulated below :—

[*For statement see next page.*

Yield Statement of Sugarcane Varieties, Amalsad Farm, 1919-20.

Plot No.	Name of Variety.	Nature of Experiment.	Area.	Yield of Gul in lbs.		Cost of Cultivation.		Brix Readings.	P. C. of Red-rot.	Weight of Canes in lbs. used as Seed and distributed.		Method of Ploughing.	Remarks.
				Per Plot.	Per Acre.	Per Plot.	Per Acre.			Used as Seed.	Sold and distributed.		
			A. g.			Rs. a. p.	Rs. a. p.						
1	Malbari ...	Local *vs.* Manjri Method.	0 5	202	5,386	70 13 1	566 10 8	13—5	Nil.	3,800	2 830	Manjri Method 4′ apart.	
2	Do. ...	Experiment	0 5	209	6,688	63 11 3	511 2 0	14—0		3,000	3,300	Local Method of sowing whole canes.	
3	Malbari ...	Java Method	0 5	950	7,600	78 14 3	531 2 4	13—5				Java Method.	
4	Pundya ...	Experiment	0 5	924	7,392	81 9 11	652 15 4	11—0	35 p. c.			Do.	
5	Bangdya ...	Varietal Experiments.	0 5	1,220	9,760	80 2 9	641 6 0	13—6				Manjri Method of planting 4′ apart.	Per cent of juice to cane =66 per cent.
6	Bassein Red ...	Do.	0 5	934	7,472	73 13 3	5 0 10 0	13—8					
7	Red Mauritius ...	Do.	0 5	258	6,860	72 11 10	581 14 8	11—54		2,420	5,500	Do.	Per cent gul to juice 13 per cent.
8	J. 247 ...	Do.	0 6	1,318	9,243	104 1. 7	693 15 10	11—75		750		Do.	
9	Stripped Mauritius ...	Do.	0 20	2,933	7,821	234 13 5	469 10 10	14—9		6,800	916	Do	
10	Manjav ...	Do.	0 20	2,786	7,429	231 14 11	463 13 10	14—9		2,500	5,400	Do.	
11	Pundya ...	Do.	0 10	1,421	5,684	132 5 3	529 3 0	10—0	40 p. c.			Do.	
12	Khadya ...	Do.	0 5	1,239	9,912	65 9 7	524 12 8	12—75				Do.	
13	Kabyria ...	Do.	0 5	389	3,112	58 3 7	465 12 8	11—18				Do.	
14	Malbari Seasonal ...		0 2	Grubbed up.								Do	
15	Pundya do. ...	Seasonal.	0 2	87	4,640	26 4 9	525 12 0	11—68	25 p. c.	1,800		Do.	
16	Do. do. ...	Do.	0 2	130	2,600	30 4 2	605 3 4	11—6+8	Do.			Do.	
17	Khajuria ...	Do.	0 2	87	4,586	23 14 8	478 5 4	11—75		1,800		Do.	

From the above it will be seen that though Bangdya tops the list in point of yield, it is not much liked by the cultivators as it is a harder variety as compared with Red and Stripped Mauritius, J. 247 and Manjav.

In this year, except Pundya, no other variety, even Malbari was affected with red-rot. Though it is too premature to draw any conclusions as regards the prevalence or otherwise of red-rot, it may be assumed that the disease is less in years of well distributed normal rainfall with regular waterings at intervals of 8 to 10 days. The disease is less as we go further south in Bulsar and Pardi Talukas, where the rainfall is heavier. In seasons of scanty rainfall or in fields which the cultivator fails to irrigate at regular intervals, the disease is more.

From the current year, the Agricultural Chemist has been pleased to take soil and water sample from the Farm and investigate the disease from chemical point of view.

(5) *Sunev Kela Plot.*

This was started in the year 1915-16 as suggested by Dr. Mann and approved of by Government as per G. R. No. 2735, R. D., dated 24th March 1914, in the Hansot Peta, Mahal of the Broach District. There was a long standing complaint from the cultivators of Sunev Kela and the surrounding villages about the deterioration of their lands due to salt efflorescence coming to the surface.

Dr. Mann suggested that green manuring with San and heavy doses of Farm Yard Manure with good deep tillage with English ploughs will remedy the evil. Four typical plots were selected in the affected area, whose results are tabulated below:—

Statement showing the Yield of Crops at Sunev Kela from 1915-16 to 1919-20.

Plot No.	Area.	1915-16.			1916-17.			1917-18.			1918-19.	1919-20.		
		Treatment.	Crop.	Yield in lbs. per acre.	Treatment.	Crop.	Yield in lbs. per acre.	Treatment.	Crop.	Yield in lbs. per acre.		Treatment.	Crop.	Yield in lbs. per acre.
	A.g.													
I	1 0	San green manuring.	Rabi jowar.	279	San green manuring.	Wheat.	135	San green manuring.	Wheat.	102	San green manuring in all the four plots as per Dr. Mann's D. O. No. 472 of 18th July 1917; and no crop due to famine.	San green manuring.	Whate	125
II	1 0	Farm Yard Manure 25 cart loads per acre.	Do.	474	Farm Yard Manure 25 cart loads per acre.	Cotton.	127	Farm Yard Manure 25 cart loads per acre.	Do.	228		Do.	Do.	170
III	1 0	Do.	Cotton.	60	Do.	Jowar failing wheat.	290	Do.	Do.	242		Do.	Do.	180
IV	1 0	San green manuring.	Rabi jowar.	337	San green manuring.	Wheat.	255	San green manuring.	Do.	189		Do.	Do.	140

From the above, it will be seen that—

(1) Plots II and III have responded to the treatment, but the question of the supply of Farm Yard Manure to such a large extent is difficult and costly.

(2) The green manuring with San on such sticky poor black soils with little more salt in them does not seem to be profitable, as San does not grow quickly on such soils and does not give sufficient stuff to the soil to make it worth while the trouble and cost.

The experiments will, however, be continued for two seasons more.

The subsoil water level of the tract varies in different seasons from 4 feet to 6 feet as the part is flat and badly drained, and unless the water level goes

down below 10 feet by any means, the chances of reclaiming the soil by such means seem doubtful.

III.—District Work.

This consists mainly of propagandistic work and is carried on by the Divisional Superintendent of Agriculture, N. D. and the District Agricultural Overseers. During the year under report, he was very short of hands. There were no District Agricultural Overseers available for Surat and Ahmedabad Districts on account of the transfers of Mr. M. M. Desai to Chharodi and Mr. D. N. Desai to Konkan Division, and as the substitutes in their vacancies were not available.

This work is divided into the following heads—

(1) Agricultural Shows and Demonstrations.

(2) Implement and Seed Depots.

(3) Demonstration Plots.

(4) Distribution of seeds and implements.

(5) Special work.

(6) Agricultural Associations.

(7) Publication of agricultural matters.

(1) *Agricultural Shows and Demonstrations.*

Parties of cultivators from different Talukas of the Surat District were brought to the Surat and Amalsad Farms, as per previously arranged programmes, and were shown the crops on the Farms and the working of the improved implements, and given detailed information on all important subjects. In addition to these party demonstrations, shows and demonstrations were held at the following places:—

Place.	District.	Show or Demonstration.	Dates.
1. Godhra ...	Panch Mahals ...	Show ...	27th October 1919.
2. Bulsar ...	Surat ...	Demonstration ...	1st and 2nd December 1919.
3. Udwada ...	Do. ...	Do. ...	21st December 1919.
4. Amod ...	Broach ...	Do. ...	10th December 1919.
5. Mahudha ...	Kaira ...	Do. ...	18th January 1920.
6. Broach ...	Broach ...	Agricultural Exhibition and Cattle Show.	26th to 29th February 1920.

The District Agricultural Overseer, Broach, also held small demonstrations on the Broach Farm for the members of the o-operative class and for the members of the Rajput Conference held there. At these demonstrations, lectures were delivered and the cultivators took full advantage of free discussion on several important agricultural methods as regards difficulty in agriculture and agricultural pests.

(2) *Implements and Seed Depots.*

In addition to the sale of implements and seeds on agricultural stations, depots are kept where implements are sold and also given on hire to cultivators.

These depots do not seem to be doing so well as in other Divisions. The depot at Godhra only sold implements worth Rs. 276-9-6 during the year. At the following depots implements are kept for hiring purposes only:—

Jamiatpura, Nardana — Ahmedabad District.

Dohad, Godhra, Halol — Panch Mahals District.

The first two depots practically did not do any hiring and will be shifted to other places to see if they do better there. At the last three depots the total amount of hire realized during the year came to Rs. 175-12-0 which is more by Rs. 53-8-0 than that realized last year. The details of implements kept at each depot and the number of days the implements were hired, &c., are given in the following statement:—

Statement showing the Working of Depots in N. D. during the year 1919-1920.

Godhra Depot.

No. of Implement.	Kind of Implements.	No. of days hired.	Rate of hire charges.	Amount realised.	Remarks.
			Rs. a. p.	Rs. a. p.	
1	C. T. 2 Plough ...	36	0 3 0	6 12 0	
2	B. T. 2 Ploughs ...	199	0 2 0	24 14 0	
3	Monsoon Ploughs. ...	59	0 2 0	7 6 0	
2	I. N. D. Ploughs ...	123	0 2 0	15 6 0	
9	Meston Ploughs ...	551	0 1 0	34 7 0	
2	Harrows ...	108	0 1 0	6 12 0	
2	Hoes ...	30	0 1 0	1 14 0	
	Total ...			97 7 0	

Dohad Depots.

No. of Implement.	Kind of Implement.	No of days hired.	Rate of hire charges.	Amount realized.	Remarks.
			Rs. a. p.	Rs. a. p.	
1	B. T. 2 Plough ...	16	0 2 0	2 0 0	
9	Meston Ploughs ...	2	0 1 0	0 2 0	
1	Maize-Sheller ...	45	0 6 0	16 14 0	
8	Hoes ...	36	0 1 0	2 4 0	
	Total ...			21 4 0	

Halol Depot.

No. of Implement.	Kind of Implements.	No. of days hired.	Rate of hire charges.	Amount realized.	Remarks.
			Rs. a. p.	Rs. a. p.	
3	B. T. 2 Ploughs ...	255	0 2 0	31 14 0	
4	Malwa Ploughs ...	42	0 2 0	5 4 0	
2	I. N. D. Ploughs ...	57	0 2 0	7 2 0	
4	Meston Ploughs ...	205	0 1 0	12 13 0	
	Total ...			57 1 0	

Value of implements kept at these depots on 31st March 1920 is Rs. 1,072.

In the Surat District a depot is kept at Bulsar, a Taluka town, where implements are given out free of charge for the sake of encouragement. A total area of about 125 acres was thus ploughed by the implements given out from this depot.

In Kaira District, the depots that were closed in the famine of 1918, were not again opened as the cultivators do not seem to take advantage of them.

On the whole, fairly good work was done by the depots in the Panch Mahals. But the recoveries do not cover the working expenses. In fact, in this Division, the depots are working at a net loss to Government, and the only object of maintaining them is to bring home the advantages of improved tillage with improved implements at the very doors of cultivators, through the Kamgars and Depot-keepers who demonstrate their working in their own villages.

In the Kaira District, some of the big land-holders have now purchased motor tractors. Many B. T. and A. T. Ploughs have been sold and are being sold to small land-holders. The depots in this District are closed and proposed to be shifted to the Ahmedabad District as a trial measure.

In the Broach District, no depot has yet been opened, and it is proposed to open one to see the result for one year.

(3) *Demonstration Plots.*

In order to bring home to the cultivators the successful results achieved on the Experimental Stations, either by manuring, tillage, rotation or the introduction of new crops, these plots are kept for convincing the owners of the plots and their neighbours of the actual advantages to be so derived and the truth of the advice given by our District Agricultural Overseers for increased yield due to better tillage or manuring or otherwise. During the year under report, there were 128 plots distributed in the whole Division as noted below. In some cases seed and manure were supplied free, while in others the cultivators carried out at their expense the trials suggested by the District Agricultural Overseers, under departmental supervision:—

Name of the District in which plots are situated.	No. of plots.	Area.		Remarks.
		Acres.	Gunthas.	
Surat ...	14	34		
Broach ...				
Kaira ...	69	36	10	
Panch Mahals ...	45	82		

In the Ahmedabad District, for want of a permanent District Agricultural Overseer no work was done in this line. In Bulsar and Pardi Talukas of the Surat District a few plots under cotton were tried as a new crop but as the after-tillage could not be carried out properly due to heavy rains, the results were not encouraging. The other plots on which jowar, wheat and onions were tried were not cared for properly by the owners. The District work in the Surat District suffers for want of a permanent District Agricultural Overseer.

In the Kaira District trials were made on different kinds of cottons on the estate of Rao Saheb Dadubhai P. Desai at Ajupura, and of manures on tobacco and vegetables on small areas on cultivators' fields. On some of the plots the results were promising, and according to the fixed plan, these will be maintained in the next season in different places except in cases where the trials are required to be continued for a year or two more.

In the Panch Mahals, experiments of sowing at different distances, better methods of sugarcane planting after Manjri Method were successfully demonstrated and the cultivation of groundnut specially, Big Japan, is increasing very much as will be seen from the following table:—

Taluka.	Area in acres under groundnut crop in the year.		
	1917-18.	1918-19.	1919-20 (Approximate).
Godhra ...	469	556	750
Kalol ...	1,525	2,140	3,200

On the whole, this kind of educative work in this backward tract is found much useful.

(4) Distribution of Seeds and Implements.

In the year under report, different kinds of seed were distributed from the different Agricultural Stations and Depots through the District Agricultural Overseers, as noted in the table below:—

Statement showing Distribution of Seeds and Implements from Farms and Depots, during the year 1919-20.

Kind.	Surat Farm.	Nadiad Farm.	Dohad Farm.	Depots.	Total.
Seeds.					
Jowars ...	5,851	3,954		12,010	21,815
Cottons ...	91,940	20	42	1,670	93,672
Paddy ...	200	33	3,530	3,280	7,043
Wheat ...			875	2,000	2,875
Gram ...			7,762	8,000	15,762
Maize ...	15		2,054		2,069
Bajri ...		742		1,360	2,102
Bhavnagri bajro ...				16,000	16,000
Groundnut ...			195	20,000	20,195
San ...		1	3,820	280	4,101
Castors ...	29	1		3,902	3,932
Vegetables, &c. ...	4,018	13		5	4,036
Sugarcane (9" sets) ...				2,824	2,824
Chicory ...		180			180
Lucerne ...	22	12		12	46
Other seeds ...	196	137	270	605	1,208
Total in lbs.	102,271	5,093	18,548	71,948	197,860
Implements.					
Number ...	37	56		36	149
Worth Rs.	494 14 0	193 0 0		569 1 6	1,256 15 6

(5) *Special Work.*

Several applications having been received by this and the Revenue Department as regards heavy damages done by wild pigs, a pig-hunting campaign in Chorashi Taluka of the Surat District was started.

In November 1919, the Collector of Surat made a reference stating that there is a serious complaint of damage to crops caused by wild pigs at Bhatha, Ichhapur and other villages of Chorashi Taluka as also elsewhere in the District and requested to organise measures for their destruction. The Divisional Superintendent of Agriculture, N. D., was thereupon requested to take up this work and organise a party for destroying these pigs. A party of 18 men was organised under the supervision and guidance of two Kamgars and the operations began from 27th February 1920. This party was joined by a party of armed policemen sent by the Collector to help in the campaign. It remained for four days and was then recalled to head-quarters. During 31 working days from 27th February 1920 to 3rd March 1920 and 11th March 1920 to 4th April 1920, 51 animals were either killed or destroyed in *khanjan* (marshy ground near the river) at a total cost of Rs. 424-3-9. This came to nearly Rs. 8 per animal. This cost was met with from Rs. 300 allotted by the Director of Agriculture and from the subscription collected by the Collector. This cost is high when compared with the cost of killing one pig in the Nira Valley. This is due to the absence of help from the villagers who seem to keep aloof from the campaign due to religious instincts. However, much relief has been rendered to the villagers by the destruction of these pigs, and the work should be continued from year to year where the trouble from these wild beasts is the greatest. From the experience gained it appears that in order to make the work more successful, a party of four shooters with guns or four policemen for every party of 12 beaters should be arranged for and the help required from the villagers should be secured through the Revenue Authorities.

(6) *Agricultural Associations.*

During the year under report, three new associations have been organised *viz.*, Matar, Thasra and Kapadvanj, in the Kaira District. The Association at Viramgam in Ahmedabad District, shown in the last year's report, was not organised at all, and hence the total number of Associations at the end of the year is 13.

Of these Associations, three are District Associations and ten are Taluka Associations. Of the three District Agricultural Associations, the Broach District Agricultural Association which had shown its activities in the beginning and which promised to turn out in due course to be a real working body on behalf of cultivators of the District, seems to have dwindled down. It held one Agricultural Exhibition and Cattle Show during the year with the help of Government contribution. But a greater part of the work of organising, arranging and registering the exhibits had to be done by the members of this Department who had to work night and day to make the show a success.

The work of the other two District Associations, though not very satisfactory, is not reported to be so poor as that of the Broach Association.

The Taluka Associations could not do any substantial work owing to their limited resources. However, it is worth noting that young Revenue Officers take interest in forming such Associations, and it is hoped that the present state of things in the case of Agricultural Associations will soon undergo a change for better, side by side with the co-operative movement.

(7) *Publication of Agricultural Matters.*

The Broach Quarterly is the only one agricultural magazine published under the auspices of the Broach Agricultural Association. In the Publishing Committee the Divisional Superintendent of Agriculture, N. D., works as a member, and the greater portion of the material is contributed by the members

of the Department. Some 500 copies are subscribed by the Agricultural Department. It is published regularly at the end of every quarter.

The Broach Agricultural Association wanted to change the magazine into a monthly one and passed a resolution to the effect in one of its meetings. The Vice-President approached the Head of the Department for more aid from Government; but in the absence of satisfactory arrangements for securing regular contributions from the members of the Publishing Committee for the magazine, the Association's proposal was not approved by the Department, as it was feared that the whole burden of supplying the material would fall on the Department's head.

IV.—Agricultural Education.

The classes on the Dohad Farm mentioned in the last year's report continued working from 22nd January 1919 and the boys were examined by the District Agricultural Overseer, Godhra, at the end of the year in March 1920. All the boys attending the course have been promoted to 2nd year's course, and a new class with 6 boys is commenced from April 1920. As regards the 14 boys of the VII Standard of the Bhil School who attended the class, five left the Bhil School after passing the Vernacular Final Examination in April 1919. Out of the remaining nine, only four were sent for the Vernacular Final Examination and five were detained. These latter will receive full training for a complete period of two years, while the former four were given as much practical and theoretical training as possible and they were examined in May last. Out of these four, three have passed the test fully and one fails by $4\frac{1}{2}$ in the total percentage of marks. The District Agricultural Overseer, Godhra, who examined these boys reports that in spite of the inferior calibre of the Bhil and Patelia boys, they have shown their aptitude for the agricultural subjects. This is the first year and no definite conclusions can be drawn regarding the training imparted, but after watching two or three batches receiving complete training for two years' course, it will be possible to judge how far the knowledge imparted to them is utilised in actual practice. The new classes begin with six boys in the 1st year's course and 11 in the 2nd year's course.

Vernacular Agricultural School at Godhra.

The buildings for this school which were proposed for construction in 1914 have been now completed and taken in charge by the Department in January last, and the school has been equipped during the year at a cost of about Rs. 4,000. It has commenced the work from June 1920. The number of boys at present is nine and it is expected that the remaining number of six boys will soon join the school. The superior staff at present consists of one Head Master, one vernacular teacher and one non-graduate fieldman.

V. Entomological Work.

The Assistant Entomologist was engaged for about three months in closing up the work of famine operations of the last year, and in disposing off the remaining Sundhia fodder crop and the Bet land dead stock materials to the best advantage.

Besides this, he was assigned a new propaganda work of organising a vigorous campaign for the control of smut disease in jowar crop, by demonstrating and distributing copper sulphate packets in the district. About 2,000 packets were thus distributed.

About 16 Entomological shows and demonstrations were made at several places in the Division during the year, where typical insect pests of the tract were exhibited and their preventive and remedial measures explained and demonstrated with the help of magic lantern lectures.

An article on Swarming Caterpillars of Gujarat (*cirphis loreyi and prodenia litura*) was prepared and published in the Agricultural Journal of India, Pusa, during the year.

As for the experimental and research work during the year, the following investigations and trials were made :—

(1) *Katra* (*Hairy caterpillar*).—The caterpillars of "Amsacta moorei" appeared in light Goradu tracts of Dohad and Jhalod Talukas in the beginning of the monsoon. They were in a more virulent form this year on account of which the cultivators had to resow their maize fields. But on the Government Farm, Dohad, light-traps were put in the beginning which successfuly entrapped large numbers of emerging Katra moths, hence the danger of caterpillar ravages was much more minimised, and the Superintendent had not to resow his fields. About 1,254 Katra moths were caught by light traps at Dohad Farm in a period of about three weeks commencing from the 17th June 1919. Out of these, 702 were females loaded with eggs and the rest 552 males.

(2) *Jowar Stem Borer.*—The Kharif jowar crop on the Surat side was found infested with two kinds of borers, *viz.*, "Chilo simplex" and "Sesamia inferens." This year their ravages were severe, which increased up to 47% in the middle of September, due to lack of parasites which were very few in the beginning of the season due to last year's famine. But later on they multiplied and increased sufficiently in number so as to keep Chilo caterpillars under control. In this way the Tachinid fly parasites increased up to 70% in the jowar crop about the middle of October as was calculated by making actual field observations.

As for the Sesamia borers which chiefly breed in winter and summer, nothing could be done till the crop was harvested. These were also found kept in check partly by the Braconid parasites.

The breeding and letting loose of Tachinid fly parasites were also resorted to as remedial measures.

(3) *Cotton Pests.*—The cotton crop at Surat Farm was found infested with three important pests, *viz.*, (*a*) Boll worms (*earias fabia*), (*b*) Cotton Stem-borer (*sphenoptera gossypii*) and (*c*) Cotton woolly mites (*eriophyes gossypii*) :—

(*a*) As for the control of boll worms, two measures were tried, *viz.*, (*i*) sowing Bhinda (*hibiscus esculentus*) as a trap crop, and (*ii*) nipping off affected top shoots of young cotton crop and destroying the same together with worms. Bhinda as a trap crop on the Surat Farm did not thrive well, but on the Dohad Farm it grew luxuriantly and successfully entrapped the pest. As for the second measure, 5,498 affected shoots of cotton were searched out and removed from the experimental area at Surat.

Over and above these measures, untimely rains of November and January greatly helped in annihilating this pest in general, as it was noticed that at the cessation of these cyclonic rains almost all the worms in bolls on the plant as well as those dropped down were found dead due to some fungoid disease.

(*b*) As for cotton stem-borer, the plants affected were removed and destroyed. In this way nearly 1,805 diseased plants were searched out and removed from an area of about 65 acres of cotton.

(*c*) Regarding cotton woolly mites, removal of affected leaves in the early stage of the crop was made from the experimental area. Secondly, a spraying trial of incosopol and sulphur sublimed solution was made in an odd area, but it did not seem to respond very well.

One more thing was found out while investigating the colonies of these woolly mites and that was the presence of a very tiny predaceous grub of a pale rosy colour, invisible to the naked eye, but readily discernible under a pocket lens or a microscope. Wherever these grubs were noticed, the colonies of mites gradually dwindled away, and the white fluffy growth of the epidermal tissues of leaves turned pale yellow and seemed to dry up.

(4) In wilted plants of Til, suffering from Rhizoctonia disease at Surat Farm, maggots of a root gall fly of a Psilid family, were observed underneath the root bark. Further investigation and study of the pest are in progress.

(5) As for the raids of jackals to groundnut crop on the Surat Farm a preparation of poison baits of white arsenic and raw flesh was tried, which was successful in warding off their further attack to the crop.

(6) The ravages of field rats were also reported in some Talukas of Broach and Surat Districts. They damaged partly the Rabi crops of wheat, pulses and cotton. But they did not seem to survive more and multiply so as to appear and spread as a field rat plague in the succeeding season. A method of fumigating their nests with sulphur fumes by means of rat exterminating machines, was shown and demonstrated.

About 85 queries relating to insect pests were received during the year, which were duly attended to by the Assistant Entomologist, and proper advice was given. Besides that, he toured, studied, and identified insect pests that appeared on Government Agricultural Stations and private Farms, and advised and adopted measures wherever possible.

During the year under report the staff, on the whole, has worked satisfactorily. Some of the graduates are seen taking keen interest in original work.

Looking to the urgency of a good Manager at Chharodi, the services of Mr. M. M. Desai who was specially trained for Dairy and Cattle Breeding, were given to that farm.

Surat
2nd July 1920.

BHIMBHAI M.,
Deputy Director of Agriculture, Gujarat.

APPENDIX D.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, CENTRAL DIVISION, POONA, DURING THE YEAR 1919-20.

STAFF.

The charge of the Central Division was held by me throughout the year except for the three and half months when I was on privilege leave. During my absence Raosaheb M. L. Kulkarni acted for me. Mr. V. K. Kogekar, L.Ag., continued to hold the charge of the Divisional Superintendent of Agriculture, Central Division, except when on leave for two and half months when Mr. B. P. Vagholkar, L.Ag., acted. Mr. M. G. Athalye, L.Ag., held the charge of the Canal Division throughout the year. Mr. K. D. Kulkarni continued to work as Cotton Supervisor and was in charge of the cotton breeding and extension work.

(1) Poona, (2) Nasik, (3) Ahmednagar and (4) West Khandesh Districts as also (5) Godavari-Pravara and (6) Nira Canals were already provided with Agricultural Overseers; (7) East Khandesh was looked after by the Cotton Supervisor in addition to his work. The latter, however, was relieved of the other district work and a special Graduate Overseer is now appointed for East Khandesh District. The Divisional Superintendents and the Agricultural Overseers (including the Cotton Supervisor) are helped by number of Fieldmen and Kamgars. In old times (say before 1915) when the Divisional Superintendents had less assistance in the district, they had to make their own observations and record results of most of the experimental and demonstrational plots themselves; the work done was naturally systematic and accurate; the present tendency of the Divisional Superintendents to shove such work on the District Agricultural Overseers who in return depend on the Fieldmen and Kamgars for such work, has to some extent reduced the quality of the work as the important work falls on the least fitted man. I am, however, taking precautions without unnecessary decentralizing.

2. Season on the whole was good and unlike last year most of the staff continued at their legitimate work.

3. *Farms and Experimental and Research Work.*—There are three Farms in the Division as given in the margin. The first is a Seed Farm and is intended to produce pure high class N. R. Cotton seed. At Dhulia we breed cotton, grow pure high class N. R. and maintain a fruit garden as a demonstration. Kopargaon Farm serves two main purposes—fodder growing and sugarcane demonstration Farm. Farms are managed through Farm Superintendents and Fieldmen under them. Work on these Farms is separately reported on and it is not proposed to describe their work in detail, only a few points of importance will be touched under important crops.

1. Jalgaon (East Khandesh).
2. Dhulia (West Khandesh).
3. Kopargaon (Ahmednagar District).

4. *District or Extension Work.*—This section is more important and engages two Divisional Superintendents, one Cotton Supervisor, seven Graduate Overseers and number of Fieldmen and Kamgars. It is through these officers that we introduce improved methods of agriculture, advise the cultivator on technical points, help him by supplying his wants (by way of bringing within his reach pure seeds, improved implements and effective manures) showing the farmer on his own land advantages of certain practices and uses of concentrated manures. It is through this Agency that we try and show the advantages of co-operative action and render help to the cultivators in combating crop pests as wild pig, insects and fungi on crops.

This section includes the introduction of N. R. Cotton seed (*see* page 49), demonstrating improved methods of raising sugarcane (page 51), demonstration plots, supply of seeds, manures and implements, managements, shows and demonstrations of Agricultural Associations, &c.

Cotton.

5. The general organization of supplying N. R. Cotton seed has often been described in the previous reports. For some years Jalgaon-Farm-seed was multiplied on the seed plots managed through the Departmental seed-growers only. To extend the work of multiplying seed we now give most of our seed to the seed-growers of the Co-operative Seed Societies and of the seed Unions and only a part of the seed-stock is given to the Departmental Seed-growers. The seed produced by the seed-growers of the Seed Societies and of the Seed Unions goes to the members of these institutions while the seed produced by the members of these Institutions as also the seed from the Departmental seed-growers goes to the common farmers. During the year under report the Department supplied 30,412 lbs. of Jalgaon and Dhulia Farm seed to the several classes of seed-growers. Apart from the distribution of N. R. seed by the Seed Societies and Seed Unions the Department alone distributed 132,950 lbs. to the farmers direct.

6. The area under cotton in Khandesh is vast and it is not possible for the Department to produce N. R. Cotton seed for general distribution through Departmental seed-growers. The work of multiplying the seed and distributing the same is, therefore, steadily transferred to the Co-operative Seed Societies and Seed Unions.

Jalgaon and Dhulia Farms.

7. Jalgaon Farm, though a seed farm, is utilised in carrying out certain experiments, the important findings of which are touched below. Average yield of seed cotton for an area of 126 acres was 546 lbs. per acre at Jalgaon and 963 lbs. per acre at Dhulia for the area of 6 acres 4 gunthas.

8. *Manuring.*—The supply of Farm Yard Manure is insufficient especially in the cotton growing tract and we had to supplement it by crude night soil, sheep folding and castor cake. At Jalgaon the areas treated were large and the work was conducted over four years (it may, however, be remembered that areas for particular manures are not fixed and hence residual effects of previous cropping are not taken into account) :—

Manures used per acre.	Average yield per acre of seed cotton in lbs.				General average in lbs. seed cotton per acre.
	1915-16.	1916-17.	1917-18.	1919-20.	
Crude night soil 20 to 30 cart loads.	1,194·6	987·75		703·8	962
Farm Yard Manure 20 cart loads.	649·51	485·45	658·8	578·9	593
Sheep folding 2,000 sheep over night.	631·79	462·27	592·2	374·8	515
Castor cake 400 lbs. ...				517·0	517
No manure ...	368·00	213·31	241·00		274

The table shows how useful crude night soil proves to the crop. It also shows that castor cake can replace Farm Yard Manure where the latter is costly. Use of night soil and castor cake is extending in Khandesh.

9. *Breeding Work and Varieties.*—Sindewahi and N. R. Cotton were compared with N. R. for the last three years. N. R. beat them every year. Mill owners often complain that the introduction of N. R. is neither useful to them nor to the cultivators; while the fact is otherwise. It was proved definitely before years that N. R. paid to the cultivators better. To corroborate this further N. V. and N. V. M. were sown side by side with N. R. on acre

plots in the years 1918-19 and 1919-20 in order to compare their receipts. The following shows average results per acre, which clearly show the advantages of N. R. over the yellow flowered varieties which are valued higher. Advantage of N. R. lies in the outturn as well as in ginning:—

Variety.	Yield per acre lbs.	Ginning per cent.	Valuation per 784 lbs.	Receipt per acre.
			Rs.	Rs.
N. V.	341·6	32·59	425	59·63
N. V. M.	344·3	30·94	425	57·5
N. R.	536·5	37·25	320	81·2

Four Comilla × Bani crosses were tried on field scale. The results are very promising as will be seen from the following:—

Jalgaon.

Names.	Yield per acre lbs.	Ginning.	Valuation per 784 lbs.	Gross value (by calculation).
		p. c.	Rs.	Rs. a. p.
N. R. (for comparison) ...	546·6	37·5	320	83 10 7
C×B IV 5^{2a} ...	564·2	38·5	415	114 15 8
C×B VI 1^{1} ...	458·4	38·5	415	99 8 6
C×B I 4^{12}_{3} ...	509·4	38·25	415	103 2 2
C×B II^{12} ...	495·4	39·18	415	102 11 10

Dhulia.

N. R. (for comparison) ...	565	37·87	340	92 12 10
C×B IV 5^{2a} ...	1,048	36·25	450	218 1 9
C×B XI 6^{10}_{2} ...	674	36·87	465	147 6 2
C×B XX 14^{6}_{1} ...	668	37·06	450	142 0 11
C×B IV 5^{a2}_{2} ...	432	35·62	450	88 6 3

The long cherished hope of putting out a superior (staple) strain which would yield as well as N. R. and ripen as early, is well within our sight and it is now proposed to sow fairly large areas with these crosses.

10. *Continued Mass Selection for Farm Sowing.*—As usual continued selection is followed year after year for sowing the Farm area.

11. *Unit Selection.*—The work as detailed in the previous report is continued. The work has not yet been very promising.

Sugarcane.

12. The work on sugarcane in this Division is divided into—

(i) Advisory and demonstrational work on the canals and in the Nasik District.

(ii) Experimental and demonstrational work on Kopargaon Farm.

13. On page 26 of Annual Report of the Department of Agriculture (1915-16) the demonstrational work on the canals was detailed and it can, with confidence, be said that the work was undertaken in very opportune time. Had it not been for our efforts the local cultivators would have lost very heavily, in fact for one or two seasons they did lose, as the prevalent methods of plainting, crushing and making gul were very crude and when the Godavari canals were first opened local farmers did not know even how to prepare lands for planting and irrigating. That work, it can be said, is done, and the local cultivator harvests as good crops as his guest Saswad Mali who came in about the year 1913-14.

14. Along with the above we have been attempting to introduce improvements and help the cultivators by way of doing the following—

(1) Economic cultivation of sugarcane—

(*a*) Opening the land deep.

(*b*) Planting sets in rows 5′ apart.

(*c*) Giving just necessary seed rate and manures and avoid waste.

(*d*) Introduction of bullock hoeing and earthing up.

(*e*) Introducing power crushing and making gul on multiple furnace.

(2) Introduction of ammonium sulphate and investigation on manures.

(3) Investigation regarding possibilities of growing cane in wet soils.

(4) Agricultural Depots.

(5) Pig killing.

15. *Economic Cultivation.*—Our work is being felt. People have not yet been converted to the (1) entirely. They give more manure than is necessary. Many have reduced seed rate from 18,000 to 12,000 or so. They plant 3′ to 4′ apart instead of 2½′ apart. Power crushing is appreciated by big farmers and some have installed power plants. Multiple furnace designed by the writer, before years, has become an adjunct of the power crusher in the Presidency. The staff could not yet find time to carry out demonstrations of wide planting carefully which however will be seriously taken up now.

16. *Introduction of Concentrated Manures.*—Introduction of ammonium sulphate is seriously taken up during the year under report, as the time was opportune. Prices of cakes rose very high and on the basis of unit value of nitrogen, ammonium sulphate was found cheaper than cakes. It may also be noted that canal cultivators (including those on the old canals like the Nira Left Bank) did not take kindly to ammonium sulphate as in Satara-Kolhapur tract where this manure was pushed since as early as 1909. A grant of Rs. 10,000 from Sir David Sassoon Fund was therefore obtained in order to introduce this useful manure on the canals. The work is undertaken in co-operation with 76 farmers. We supply only ammonium sulphate, the farmers do and pay for everything else. Ammonium sulphate plots receive 30 cart loads of farm yard manure, 75 lbs. nitrogen in cake and 75 lbs. in ammonium sulphate. Control plots are provided.

17. Part of the Sir David Sassoon grant was spent in giving about 8 per cent. concession to other cultivators, on the cost of ammonium sulphate, who agreed to follow our advice. The Union Agency, who deal in this stuff,

gave a rebate of 5 per cent. to the cultivators who purchased this manure from them at our instance. As a result of this propaganda ammonium sulphate worth Rs. 20,000 has been used by the canal farmers.

18. Some plots were designed to compare ammonium sulphate and sodium nitrate alone and in combination with oil cake. The results quoted below are not quite satisfactory. Yet they indicate that a combined application of oil cakes and sulphate of ammonia or sodium nitrate is more advantageous than that of sulphate of ammonia or sodium nitrate alone. They also show that nitrogen in the form of sulphate of ammonia is distinctly superior to that of sodium nitrate for sugarcane. The results further suggest that generally the selection of a particular kind of concentrated manure should be based on the unit value of nitrogen in the concentrated manures.

Results of Manure Plots of Sugarcane (Pundia) on Cultivator's Fields.

Serial number of plots.	Kind of manure applied as top dressing.	Quantity applied per acre in lbs.	Number of doses.	Outturn of gul per acre in lbs.	Remarks.
	I. Savalvihir.				
1	Sulphate of ammonia ...	360	In 2 doses mixed.	7,226	
	Safflower cake ...	1,068			
2	Sulphate of ammonia ...	720	In 2 doses.	5,320	
3	Sodium nitrate ...	960	Do.	3,360	
4	Sodium nitrate ...	480	In 2 doses.	5,092	
	Safflower cake ...	1,068	3rd dose.		
5	Safflower cake ...	3,000	1st dose.	5,098	Check plot.
	Castor cake ...	1,500	2nd dose.		
	II. Jeur.				
1	Sodium nitrate ...	480	In 2 doses.	7,884	
	Safflower cake ...	1,068			
	Castor cake ...	1,080	3rd dose.		
2	Sulphate of ammonia ...	380	In 2 doses.	8,968	
	Safflower cake ...	1,068			
	Castor cake ...	1,080	3rd dose.		
3	Sodium nitrate ...	942	In 2 doses.	6,384	
	Castor cake ...	1,080	3rd dose.		
4	Sulphate of ammonia ...	720	In 2 doses.	9,196	
	Castor cake ...	1,080	3rd dose.		
5	Safflower cake ...	1,920	1st dose.	9,612	Check plot.
	Castor cake ...	2,400	2nd dose.		

NOTE.—In all plots approximately 150 lbs. of nitrogen was applied per acre as top dressing.

18. Fish, cake and concentrated manures are being used to supplement the Farm Yard Manure and yet the supply is not sufficient. One of the very

important sources which can relieve the situation is night soil. In the big cities of this Division, part of the night soil is turned into poudrette and used as manure. At Jalgaon (East Khandesh) crude night soil is carted straight to the fields. Both poudrette and crude night soil are found to be very good manures but prejudice and difficulty in handling these have restricted their use. At Kopargaon I have been trying to device least objectionable method of conserving and utilizing night soil as manure.

19. The cultivators in the canal tracts have hitherto been devoting their best attention and resources to the cultivation of cane alone. With a view to make them less dependent on sugarcane, other valuable garden crops are being introduced in the canal tracts. Accordingly a number of demonstration plots have this year been maintained on the Nira, Pravara and Godavari canals and cultivation of turmeric, bananas, groundnuts, onions and tobacco shown thereat. Plots of N. R. Cotton have also been arranged at suitable places.

20. *Java Method for wet lands.*—Java Method of planting cane was continued and on fourteen waterings a good crop was raised. Part of the crop was used for seed. The estimated quantity of gul per acre came to 8,440 lbs. a good outturn for the land indeed.

21. The work of the Depots was appreciated by the farmers and implements were freely taken on hire (for details, *see* page 57).

22. *Pig killing.*—The work of killing pigs as described on page 44 of the last year's report was resumed near Baramati, Malegaon and Pandara. The campaign was carried on for 41 days and resulted in killing 71 pigs (out of 127 sighted) at a cost of Rs. 583. The campaign is continued. As a result of the work of the last year and this year, the number of pigs in the tract has decreased.

Kopargaon Farm.

23. During the year under report new cane was not planted as there was not sufficient supply of water in the reservoir. The ratoon kept gave very good outturn of gul, while due to the high prices the crop left splendid profits.

24. Improved method (otherwise called Manjri or wide planting method) has been found to give better results both in outturn and more so in profits as the method saves in cost of cultivation. This year's experience of ours is however worth observing, as it goes to corroborate the general opinion of the farmers. The farmers in the canal areas especially on the new canals take one, two and often three ratoons and they complain that the ratoon of the new method does not give as good harvest as that of old. The following table shows the outturn, gross receipts, cost of cultivation and net profits per acre of the two plots (*i.e.*, local and new method) for the first ratoon. Area of the plots was 30 gunthas each. In old method rows were $2\frac{1}{2}'$ apart in beds and in the new method cane was planted 5′ apart in long rows. The plots received equal qualities of manures (225 lbs. of nitrogen per acre; 75 lbs. in the form of safflower cake for the first top dressing and 150 lbs. of nitrogen in the form of castor cake for the second and third doses together). The variety of cane was Pundia:—

Method.	Outturn per acre.		Cost of cultivation.	Net profit per acre.
	Weight of gul.	Value of gul.		
	Lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Local method ...	9,610	1,652 14 8	501 4 0	1,151 10 8
New method ...	8,086	1,390 12 8	489 5 6	901 7 2

The point will be borne in mind for further investigation and corroboration.

25. *Varieties.*—The table below, showing the outturn of the plant and (first) ratoon crops of the several varieties shows that Red Mauritius and Red Sports are likely to do well on the canals :—

	Outturn of gul per acre.		
	Plant cane 1918-19.	First Ratoon 1919-20.	Average.
	lbs.	lbs.	lbs.
Red Mauritius ...	9,981	9,134	9,557
Green ,, ...	6,608	6,516	6,562
Red sport ...	7,408	8,420	7,914
B. 376 ...	7,432	7,111	7,271
B. 208 ...	8,448	5,100	7,774
Striped Mauritius ...	3,296	7,173	5,234
Manjav ...	3,648	8,413	6,531

It is also observed on one of the plots on the canals that Red Mauritius cane resists the effects of salts better than Pundia, further investigation on this point is being continued at Nimgaon (Godavari Left Bank).

Fodder Growing and Storing.

26. The famine of 1918-19 has proved how useful fodder farms are. The fodder farm at Kopargaon grew 244,152 lbs. of (dry) kirbi and actually distributed 352,951 lbs. in the famine year to the general public there being some old stock on hand. Last year (1919-20) was a good year. The present season (1920-21) however does not promise to be a good one. The Collector of Ahmednagar District has just (early in August 1920) requisitioned all our stock of kirbi to meet the scarcity of fodder in the district. During the year under report the following quantities of fodder were produced on the Farm :—

Kirbi (dry) 412,703 lbs.

Green fodder 201,638 lbs.

Bhusa 5,472 lbs.

Besides 35,533 lbs. of grain (fodder seeds) and 33,755 lbs. gul and 14,000 lbs. green tops of cane from the sugarcane section of the Farm. Nilwa, Maize, Sundhia, Sunflower, Hundi (late Rabi jowar), Lucerne, Guinea grass, Marvel grass, Shevari and Dhaincha were grown. Nilwa is our main stay. It does well and pays to grow. Hot weather crops pay only occasionally. Of the perennial crops Lucerne thrives and leaves good profit. In the salt area where nothing can grow Shevari has been found to do well.

Fodder Crops.

27. *Nilwa.*—It was grown on 7½ acres. Average outturn per acre was 5,101 lbs. (of dry kirbi). Net profit per acre (taking into account the rental, water charges, supervision, interest on outlay, &c.) being Rs. 35-12-10.

Lucerne.—Outturn for the first year was 35,290 lbs. and in another plot (for the third year) 30,106 lbs. per acre, net profit being Rs. 67-8-10 and Rs. 168-11-5 per acre, respectively.

Marwell.—It is a perennial grass and when once established it gives good cuttings of nice grass. In most years it will pay better than dry crops in Ahmednagar District. Outturn per acre was 5,524 lbs. of green grass, net profit comes to between Rs. 12 to 16.

Shevari.—If Shevari is sown in wet land (and there is very large area of such lands lying waste in the canal tracts) and care is taken till it establishes, it gives good outturn without irrigation. Our experience indicates that it may be sown 4′ apart in rows and allowed to grow to 5′ before it is cut for the first time It should be cut leaving 3′ stem always. This encourages tillers which make good fodder and keep the root system in healthy condition. This kind of cultivation of Shevari crop will, it is expected, improve the soil as the crop sends its long stout roots deep in the soil. In addition to the leaf dropped and incorporated into the soil at the time of interculturing the mass of root system, which it is proposed to leave in the soil at the time of removing the crop, will help to open the land. In wet lands the outturn per acre comes to 13,000 lbs. to 14,000 without irrigation; net profit being about Rs. 25 per acre whereas the lands do not lend themselves to any other cropping at present.

28. *Ensilage.*—The Farm is provided with a silo which is found to be very useful. Last season when monsoon threatened, about 33,299 lbs. of Hundi and Maize fodder was in the field (standing). All this could be turned into silage. The loss in weight was only 18 per cent. In February-March again 20,000 lbs. of cane tops are put in the silo. If it was not for the silo we could not have saved Hundi nor used cane tops. Where power plant is used in milling, cane tops are mostly wasted.

By way of demonstrating the use of silage a demonstration silo was built last year at Belgaon (near Nasik) with the funds provided by Sir David Sassoon Trust Fund. 10,226 lbs. of green grass was put in the silo in September. The silo was opened last March when 5 740 lbs. of silage (56 per cent. of the original weight) was obtained. Two more demonstration silos are being erected in Khandesh District.

29. *Manuring.*—Experiments with ammonium sulphate, castor cake farm yard manure, with no manure as a check plot show that it pays to apply concentrated manures like ammonium sulphate and castor cake to fodder crops.

Power Plant.

30. *Baling and Shredding Plant.* The plant worked for 56 days (336 hours altogether) and dealt with 402,475 lbs. of fodder and produced 7,771 bales weighing 320,723 lbs. net. Loss in baling was 11,722 lbs. or about 2·8 per cent. Cost of baling including the cost of wire came to Rs. 0-3-7 per bale (of 50 lbs. each). The bales are found very useful for storage and transport. The process of shredding and baling renders kirbi more palatable and at the same time is more economical as there is practically no waste.

31. *Milling Cane.*—The same plant is made use of in milling cane. During the year under report 4 acres 30 gunthas of the Farm cane and 3 acres 10 gunthas of a neighbourer's crop was crushed.

Other Miscellaneous Works.

32. *Agricultural Depots.*—These serve a very useful purpose in supplying the wants of the cultivators and are found useful centres for introducing agricultural improvements as they bring the Departmental officers in close touch with the actual farmers. There are about 31 Depots for hiring out implements, two of which stock seeds, manures, implements and spare parts for sale; remaining stock implements for giving on hire. The following three statements give the

distribution of seeds, manures and implements; while the fourth gives the amount of hire earned on implements kept in several depots:—

33. *Distribution of Seeds.*—

Tracts.	Kind of seed.	1917-18.	1918-19.	1919-20.
		Lbs.	Lbs.	Lbs.
Division proper ...	Cotton seed	129,610	101,079	132,950
	Other seed	35,868	112,601	112,997
Canal charge ...	Cotton seed			4,034
	Other seeds	3,647	5,665	7,384
Farms ...	General seeds		19,101	5,407
		169,125	238,446	262,772

In addition 11,855 suckers of Basrai plantain and small quantities of several kinds of vegetable seeds were distributed.

34. *Distribution of concentrated Manures.*—

Tracts.	1917-18.	1918-19.	1919-20.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Division proper ...	1,130 5 9	4,150 0 0	1,279 12 0
Canal charge ...	10,371 11 9	12,617 3 8	34,325 0 0
Farms ...	98 15 8	169 9 7	224 15 0
	11,601 1 2	16,936 13 3	35,829 11 0

Use of oilcake and fish is well known to the cane growers on the canals. In this tract therefore more attention was paid to the supply of ammonium sulphate; the use of oilcake for other crops is a new introduction. However fairly large quantities of cake could be distributed for irrigated crops in the Deccan and for cotton in Khandesh.

35. *Distribution of Implements.*—

Tracts.	1917-18.	1918-19.	1919-20.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Division proper ...	7,544 0 9	2,326 4 0	2,314 2 0
Canal charge ...	5,318 7 9	1,317 14 0	790 0 0
Farms ...		822 12 0	557 3 0
		4,466 14 0	3,661 5 0

36. *Hire of Implements.*—

Serial Number	Name of the Depot place.	Taluka.	District.	Hire collected during 1917-18, 1918-19, 1919-20.			Remarks.
				1917-18.	1918-19.	1919-20.	
				Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	Agricultural, College Poona, Junnar.	Haveli, Junnar.	Poona ...	89 9 0	44 3 0	81 0 0 9 1 0	Agricultural College Farm Depot transferred to Junner.
2	Loni School ...	Haveli ...	Do. ...	251 5 0	139 1 0	306 5 0	
3	Vadgaon, Hadapsar.	Do. ...	Do. ...	161 6 0	53 13 0	157 0 0	
4	Mandavgan ...	Shirur ...	Do. ...	201 8 3	173 10 6	76 10 0	
5	Peth ...	Khed ...	Do. ...	38 14 0	9 2 0	29 10 0	
6	Pandeshwar ...	Purandhar...	Do. ...	51 8 3	7 6	56 12 9	
7	Baramati ...	Baramati ...	Do. ...		42 14 6		
8	Ahmednagar ...	Nagar ...	Nagar ...	139 0 6	141 15 0	313 12 0	
9	Pimpalgaon Pisa ...	Shrigonda ...	Do. ...	131 8 0	175 2 0	195 15 0	
10	Karjat ...	Karjat ...	Do. ...	20 6 0	19 5 0	22 13 0	
11	Sangamner ...	Sangamner...	Do. ...	25 11 0	15 6 0	72 8 0	
12	Shevgaon ...	Shevgaon ...	Do. ...	286 6 3	156 4 3	308 6 0	
13	Newasa ...	Newasa ...	Do. ...	125 10 0	146 8 3	253 5 0	
14	Kopargaon, Kopargaon Farm.	Kopargaon ..	Do. ...	666 8 3 155 9 6	160 11 0 93 3 6	300 11 6	Kopargaon Farm Depot abolished.
15	Pohegaon ...	Do. ...	Do. ...	379 2 3	6 12 0		Pohegaon Depot is transferred to Padhegaon.
16	Padhegaon ...	Do. ...	Do. ...	42 3 6		0 12 0	
17	Manjur ...	Do. ...	Do. ...	471 5 0	128 3 6	67 11 0	
18	Kolhar ...	Rahuri ...	Do. ...	153 1 0	17 1 0	54 12 6	
19	Aswi ...	Sangamner..	Do. ...		0 3 0	18 9 0	
20	Nasik ...	Nasik ...	Nasik ...	121 13 0	141 4 0	101 10 6	
21	Deola ... Chandwad ...	Kalvan ... Chandwad. ..	Do. ...	71 0 0	168 13 0	100 14 0	Deola Depot transferred to
22	Ozar ...	Niphad ...	Do. ...	165 13 0	30 8 0	68 6 0	
23	Brahmangaon ...	Sinnar ...	Do. ...	269 13 0	161 15 0	158 6 0	
24	Ner ...	Dhulia ...	West Khandesh.	17 1 0	11 0 0	29 9 0	
25	Shindkheda ...	Shindkheda..	Do. ..	26 10 0	22 13 0	5 5 0	
26	Nandurbar ...	Nandurbar...	Do. ...	4 11 0	5 7 0	0 12 0	
27	Dhulia Farm ...	Dhulia ...	Do. ...	64 1 1	4 0 0	27 12 0	
28	Shirpur ...	Shirpur ...	Do. ...	8 4 0	8 4 0		
29	Jalgaon Farm ...	Jalgaon ...	East Khandesh.	57 0 0	25 3 8	92 9 0	
30	Chalisgaon ...	Chalisgaon...	Do. ...	60 9 6	45 8 0	78 9 0	
31	Amalner ...	Amalner ...	Do. ...	40 8 0	15 0 0	42 10 0	
			Total ...	4,297 13 4	2,173 10 2	3,032 0 3	

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NOTE.—During the year under report two ploughs, one hand hoe and one disc-harrow was given for free use to the Union Agency in the famine time. The hire thus lost to the Department comes to Rs. 142-8-0. The implements were given from the Vadgaon Implement Depot. The above sum is considered as a subsidy to the Firm for famine fodder production.

37. Iron ploughs are largely used in the Deccan since 1908-09 and they have come to stay here. In Khandesh it is making rather slow progress. The progress however is steady, for the plough is catching as will be seen from the figures showing the sale proceeds and hire of implements.

38. *Demonstration Plots.*—With a view to take agricultural improvements to the farmers themselves a large number of demonstration plots are instituted on private farms in co-operation with their owners, generally the

Department bearing part or whole of the price of concentrated manures, the owners attending to the work and paying for the remaining cost of cultivation. In the case of rice, spelt-wheat, chilies (irrigated) and cotton an application of 400 lbs. of castor cake per acre has given 25 to 50 per cent. increase in the yield. In the case of onion 400 lbs. of castor cake and 40 lbs. of ammonium sulphate per acre has given an increase of 30 per cent. in outturn; value of the increase minus the cost of manures varied from Rs. 100 to 138 per acre. In the case of sugarcane ammonium sulphate in combination with oilcake (together containing 150 lbs. of nitrogen for top dressing) has proved more advantageous than cake alone or cake and sodium nitrate. Besides, wide planting of cotton (that is Khandesh Method of sowing and interculturing) in Nagar District and Satara Method of raising and curing tobacco in parts of Poona and Khandesh Districts were demonstrated in cultivators' fields. Grape gardens were sprayed for the cultivators.

39. *Shows and Demonstrations.*—One fairly big Agricultural Show (at Satana) and six demonstrations were held during the year. The Satana Show was found very useful in arousing agricultural interest in that part of the country. Besides Farm demonstrations were held on Jalgaon and Kopargaon Farms where a large number of cultivators were shown what we are doing on our Farms. Cultivators were very much impressed with the permanent improvements of the lands, conservation of manures, labour saving devices, use of chaff cutters for chaffing and storing the chaffed material, use of oilcake for cotton and fodder crops as also the use of crude night soil for cotton. A small party, taken to Charodi Farm, was very much impressed with the work of mowing machine and hay making in general, as a result of which cultivators of Mahalunge (Taluka Khed) mowed 87 acres of grass with a mower lent by the Department. The charges for cutting and tying into bundles (including hire of the mower) came to Rs. 1-13-6 against Rs. 5 per acre when cut by hand.

41. *Agricultural Associations.*—The total number of Agricultural Associations in the Division is 32 including the Irrigators' Associations at Kopargaon and Baramati. Eleven of these are doing good work, Jalgaon, Dhulia, Pachora and Raver having engaged their own Agricultural Overseers. Agricultural Associations in Khandesh extend N. R. Cotton, introduce improved implements and encourage fruit culture. Agricultural Associations at Jamner and Shirpur have opened cattle breeding Farms. Irrigators' Associations have made themselves popular by ventilating the grievances and watching the interest of irrigators. Deccan Agricultural Association issues Shetki and Shetakari magazine as usual.

Establishment.

41. The staff on the Farms and in the district, with solitary exceptions put in very good work.

Poona, dated 19th August 1920.

P. C. PATIL,
Deputy Director of Agriculture,
C. D.

APPENDIX E.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, SOUTHERN DIVISION, DHARWAR, DURING THE YEAR 1919–1920.

Staff.

Rao Saheb M. L. Kulkarni held charge as Deputy Director of Agriculture till the end of October 1919 when Mr. Gilbert, who was on Military duty, for more than three years, returned and took charge of the office on 31st October. After six months' work, Mr. Gilbert went on long leave handing over charge again to Rao Saheb Kulkarni on 1st May 1920.

2. Mr. D. H. Tagare was Divisional Superintendent of Agriculture throughout the year and Mr. Salimath as Inspector of Agriculture in charge of Dharwar and Belgaum Districts.

3. In view of the extension work of the new strains of cottons, *viz.*, Dharwar No. 1 (Kumpta Selected) and Gadag No. 1 (Upland Type of D. A. Cotton) a temporary establishment, consisting of one Cotton Superintendent and three graduate assistants, has been created since October last. Mr. V. R. Dharwarkar who was already in charge of District Cotton Work was appointed to the post of the Cotton Superintendent. His main duties are to give advice to registered seed growers, to supervise crops grown by them from Farm seed, to select fields of good crops, to arrange sales of the produce separately through Co-operative Sale Societies and get back sufficient seed for general distribution on larger areas direct or through Co-operative Seed Societies. He is also required to assist all the Cotton Sale Societies in the Division in classifying varieties of cottons while selling, approved by the Department and helping them in securing good seeds of local cottons for general distribution. He is assisted by two graduates. Mr. I. S. Kulkarni of Gokak Farm who had worked in the Cotton Branch for sometime, was appointed under him. But unfortunately he died of Influenza. Mr. Kulkarni was a steady worker. The Department lost an experienced hand by his death. The post is now filled up by Mr. H. B. Kulkarni (a graduate) who is stationed at Gadag. The other post of the assistant under the Cotton Superintendent is still vacant for want of a graduate.

4. The third assistant is to help the Cotton Superviser Mr. G. L. Kottur in his breeding and selection work of the different types of cottons on Government Farms at Dharwar and Gadag. This post is also vacant for want of graduates. Mr. Kottur's work is increasing day by day.

5. Mr. S. V. Shevade, Superintendent, Dharwar Farm, was on furlough during the whole year. Mr. G. R. Deshpande acted for him. In his absence at Gadag Mr. H. B. Kulkarni was in charge of that Farm. There were no other important changes in the superior staff of the Division.

General.

6. The general line of work undertaken by the Department of investigation on Farms, and introduction of improved methods, &c., in the districts, was the same as in previous years. The latter is however increasing day by day. In addition to its usual work, the District staff had to collect during the year large quantities of seeds of different varieties of crops, which were lost in certain tracts in the previous year owing to famine and transport the same to distant places for distribution. The seeds of early varieties of rice and jowar, along with large quantities of other ordinary seeds, were of special use to poor cultivators to get an early harvest of food grains.

Implements.

7. The sudden fall in the sale of implements during the last year, owing to high prices on account of war and famine conditions, is rising again,

notwithstanding the increased prices for improved implements and it is expected that with good organisation, the progress, in this line of work, would be marvellous. The great defect in the present organisation of selling imported agricultural implements, is the shortage of spare parts at different depots. If this defect is removed in some or other way, the demand for improved agricultural implements would increase very rapidly.

8. The following statement of implements sold from the year 1913-1914 through Departmental depots is given for information:—

Serial No.	Year.	Gross value of implements sold.
		Rs.
1	1913—1914	4,000
2	1914—1915	6,000
3	1915—1916	26,000
4	1916—1917	38,000
5	1917—1918	52,000
6	1918—1919	17,500
7	1919—1920	25,300

9. Besides the above, three power cane crushers and two oil engines at a cost of Rs. 8,500 were purchased by Messrs. Shirgaonkar and Patharpekar and ploughs and bullock power mills of the value of Rs. 4,000 were purchased by the cultivators in the Belgaum District, direct from the manufacturers and importing firms as advised by the District Agricultural Overseer. At Sholapur the work of selling and hiring of ploughs and sugarcane mills is undertaken by private bodies. One sub-agent at Sholapur sold during the year more than 400 ploughs of different makes (*viz.*, Kirloskar, Arlington and C. T. 1 of Ransomes).

10. The details of implements sold by the different implement depots under the control of the Department are given below:—

Serial No.	Name of Depot.	Value.
		Rs.
1	Dharwar Farm ...	4,104
2	Gadag Farm ...	3,092
3	Devihosur Agricultural School ...	1,188
4	Gokak Farm ...	2,903
5	Belgaum Depot (including ten sugarcane mills) ...	6,031
6	Bijapur Association ...	6,577
7	Sholapur Implement Depot ...	1,408
	Total ...	25,303

11. The new line of work, *viz.*, hiring out of improved agricultural implements undertaken by the Department a few years since as demonstrations to others to be taken up on extended scale, has proved a great success. A large number of ploughs are now kept for hire by Agricultural Associations, Co-operative Implement Societies and private bodies. Advantage of these implements is taken by poor cultivators who are unable to buy the same for themselves at high cost.

12. The following statement gives the details of implements hired by different institutions and the amount of hire realised till 31st March 1920 :—

Serial No.	Name of Institution.	Details of Implements hired.	Value on 31st March 1919.	Amount of hire realised.	Cost of repairs.	Percentage of recovery on capital.	Value of implements on 31st March 1920.
			Rs. a. p.	Rs. a. p.	Rs. a. p.		Rs. a. p.
1	Gokak Farm ...	3 Ploughs ...	185 0 0	82 7 0	44 3 0	20·8	160 0 0
2	Gadag Farm ...	9 Ploughs and Wheat threshers.	448 0 0	86 0 0	20 6 9	19·2	417 0 0
3	Devihosur School Farm.	7 Ploughs ...	343 0 0	69 5 6	8 3 6	19·0	318 0 0
4	Sholapur ...	22 Ploughs ...	910 4 0	217 3 0	9 8 0	22·8	851 6 0
5	Dharwar Agricultural Association.	30 Ploughs ...	1,075 0 0	665 12 4	103 12 0	56·41	1,033 0 0
6	Bijapur Association...	3 Ploughs ...	156 0 0	51 0 0	Nil.	32·6	141 0 0

13. From the statement above it will be seen, how profitably this new line of useful work can be taken up by well to do people. The Dharwar District Agricultural Association has taken up the work on business line and its yearly income is increasing year by year. It is hoped that all other agricultural associations in the Division will follow the example of Dharwar. This is the first useful and easy kind of work which agricultural associations and non-credit societies can undertake to help the poor agriculturists to improve their lands.

Shows and Demonstrations.

14. A large number of demonstrations of ploughs and other useful agricultural implements, ploughing competitions and of improved method of cultivation in cultivators' fields with artificial manures, on different crops were arranged by the Divisional Superintendent and Inspector of Agriculture throughout the Division. The total number of such demonstrations and competitions held during the year was 31 in all and the prizes given amounted to Rs. 107. Full details of these demonstrations are given in the report of these officers. The most important of these was the one with power crusher and triple furnace, arranged by Mr. Salimath at Benkanhalli near Belgaum with the result that three power crushers and oil engines were bought by big sugarcane growers. The demonstration was attended by about 400 cultivators. The next in important was the one of growing sugarcane at Hirekodi in the Chikodi Taluka under the advise and supervision of the Fieldman attached to the Prince Victor Fund Committee. The new method was shown to a large number of sugarcane growers, under well-irrigation. The advantage of iron ploughs for sugarcane cultivation was also demonstrated on the spot. The useful result of this demonstration was, that during the current year 20 cultivators have planted sugarcane on 31 acres under the new method of 5 feet apart. As the people are convinced of the great saving of water in the new method, there is great possibility of the method being very popular in the Chikodi-Hukeri sugarcane tract, under well-irrigation. The Collector of Belgaum attended the demonstration.

15. The demonstration of Poona Furnace and improved method of gul making arranged at various places in the Mallad tract, have produced good effects on the minds of the sugarcane cultivators, especially in the Kalghatgi Taluka.

16. The new method of planting sugarcane at 5 feet apart has now been a common practice at Sholapur. The method is gradually being introduced in the Satara District.

17. In all our demonstrations the use of copper-sulphate against smut in jowar, is either explained in the course of lectures or the method of steeping

is actually shown to cultivators. Yet it is surprising to note that the method is not becoming as popular as it ought to be. On enquiry the following reasons are attributed for the slow progress :—

(1) Carelessness of the cultivators in not getting the packets previously.

(2) Non-availability of packets on the spot at sowing time.

(3) Non-appearance of disease in some years.

However attempts are being made to convince the cultivators that the method of steeping, is so cheap, and the advantages so great, that the saving of the crop from the disease in one bad season, would cover the cost of steeping seed in hundred seasons. With all our efforts only a few educated cultivators are steeping the seed at sowing time.

18. The following are the details of copper sulphate packets distributed during the year :—

Serial No.	Name of distributing officer.	Number of packets.	Amount realised, in Rs. a. p.
1	Mamlatdars of Dharwar District ...	2,350	146 6 6
2	Mamlatdars of Bijapur ,, ...	1,100	68 6 6
3	Mamlatdars of Belgaum ,, ...	224	14 0 0
4	Inspector of Agriculture, Dharwar ...	1,766	110 6 0
5	Divisional Superintendent of Agriculture, S. D., Sholapur.	1,280	80 0 0
	Total ...	6,720	419 3 0

19. As stated in previous reports, it is extremely difficult for the limited staff of this Department to distribute large number of packets in a short period of sowing jowar all over the places. This important work of simultaneous distribution at different places must be taken up by other agencies such as village officers and Co-operative Societies.

Silos.—Two pacca silo pits at a cost of Rs. 1,133 were constructed fo demonstration in this Division, one at Mommigatti near Dharwar and another at Sholapur, the cost being met from the special fund provided by the Board of Trustees to Sir Sassoon David Fund for agricultural improvements. The pit at Mommigatti was filled in with green grass while at Sholapur it was filled in with specially grown maize fodder. The silage in both the cases was of good quality and the people appreciated the advantage of such stored green fodder for cattle in the hot weather. In filling the silo at Mommigatti, the mowing machine on the Tegur Farm had to be lent. Without such machine, it would be costly to cut large quantity of green grass within a short period. It now remains to be seen how ordinary cultivators would get over this difficulty. Thus it is decided to demonstrate small pits in Mallad for filling in grass whereas bigger ones might do for specially grown bulky fodders like maize.

Fruit Trees.

20. The District Agricultural Overseers, especially Mr. Neginhal of Belgaum is taking great interest in improving the existing old fruit garden. He pruned during the year 150 ill-shaped mango trees at Kittur and 100 fig trees at Athani. These, together with those pruned by him during the last year, are making good progress and serve as demonstration gardens. As usual

mango grafts of guaranteed varieties (800) were obtained from Ratnagiri through the Deputy Director of Agriculture, Konkan, and supplied to local planters at Dharwar. The total number of mango grafts (Alfanso variety) brought from Ratnagiri and supplied to planters during the last 7 years, amount to more than 5,000. To meet the increasing demand for mango grafts and other fruit trees, it is decided to start a nursery on the Dharwar Farm on a fairly large scale. A large number of plaintain suckers (over 1,200) were ordered and supplied by the District Overseers to cultivators in the Belgaum District.

21. *Distribution of Seeds and Manures.*—As stated in para. 6 above, a large quantity of special and ordinary varieties of seeds were purchased, where available, and distributed in different places where the need was great for such seeds. The following are the details of seeds distributed:—

Serial No.	Name of variety.	Quantity in lbs.
1	Paddy	240,010
2	Jowar	36,860
3	Wheat	78,000
4	Tur	12,140
5	Groundnut	17,804
6	Kulthi	3,357

22. The total money transactions in distributing the above seeds amounted to Rs. 46,360, and there was a net loss of Rs. 1,967-5-0 to Government which is very trivial compared with the timely supply of seeds to needy cultivators. Had it not been for the arrangements made by the Department, a large area under rice in Mallad, especially in the Dharwar District, would have remained unsown.

23. Small quantities of other seeds such as cabbages, knowlkhols, tobacco, turmeric, and sugarcane sets and fodder varieties of jowars (Sundhia and Wagar) were supplied on applications from cultivators at cost price.

24. As a result of various successful top-dressing experiments on sugarcane and paddy crops, the use of ammonium sulphate and cake manure is fast extending in the Belgaum District. In the Sholapur and Satara Districts the application of ammonium sulphate to sugarcane as a top dressing has now become a common practice in important sugarcane growing centres. The Union Agency have now their own Sub-agents at Sholapur for selling ammonium sulphate. The following artificial manures were obtained for cultivators in the Belgaum District:—

Se No.	Kind of manure.	Quantity in tons.
1	Ammonium sulphate	12½
2	Karanj Cake	20
3	Groundnut cake	30
4	Saffl wer cake	11¼
5	Fish manure	26

Crops.

25. *Cotton.*—There has been no change in the policy of District cotton work, which was finally settled last year, except that the work of roguing 5,000 acres of the two varieties of cottons, *viz.*, Dharwar No. 1 and Gadag No. 1 is to be left to cultivators themselves, as the work is found beyond control of the limited staff of Department.

26. *Dharwar No. 1.*—The progress of extension of Dharwar No. 1 (Kumpta Selected) has not been as rapid as was originally expected, while that of Gadag No. 1 (Upland Type of D. A. Cotton) has been very satisfactory, the reason being that the per acre yield of the former has not been uniformally greater than the local cotton wherever it was introduced, and as a consequence of which cultivators in certain villages (near Hubli where large area was sown last year) are unwilling to substitute on wholesale scale, this new type for the local Kumpta. They also found that Dharwar No. 1 was more susceptible for wilt than local cotton. In some other tracts the variety has done well and efforts are being made to supplant the old mixed Kumpta Cotton and substitute the new selected type.

27. To test the per acre yield of the selected type (Dharwar No. 1) with the ordinary local Kumpta in different tracts, arrangements were made through the District staff to carry out comparative experiments in cultivators' fields. The season, as a whole, was not favourable to both the cottons, for decisive opinion, as the yields in both the cases have been far below the average. However the results go in favour of the selected type in the majority of cases. The following are the results of District experiments:—

Serial No.	Village where trials were taken.	Talukas.	Name of growers.	Name of cotton.	Area sown, acres.	Yield of the area.	Yield per acre.	Ginning percentage.	Value of Kapas sold in auction.	Extra profit per acre over Ordinary.	Remarks.
									Rs. a. p.	Rs. a. p.	
1	Hebli ...	Dharwar ...	Mr. Krishnaji V. Nadgir.	Dharwar No. 1.	4	1,230	307½	28·2	68 1 3	14 15 3	Sold at Hubli auction at Rs. 300 per Naga.
	Do. ...	Do. ...	Do.	Kumpta Ordinary.	4	1,040	260	25·4	53 2 0		Sold at Hubli auction at Rs. 275 per Naga.
2	Navalgund.	Navalgund.	Mr. Gangangouda Patil.	Dharwar No. 1.	4	860	215	27·5	47 15 0	8 10 5	At Hubli auction at Rs. 300.
	Do. ...	Do. ...	Do.	Kumpta Ordinary.	4	770	192½	25·7	39 4 7		At Hubli auction at Rs. 275.
3	Neginhal ...	Bailhongal.	Do.	Dharwar No. 1.	1	121	121		21 11 0	5 7 9	Sold privately at Rs. 242.
	Do. ...	Do. ...	Do.	Kumpta Ordinary.	1	90	90		16 3 3		Do.
	Do. ...	Do. ...	Do.	*K. Cross* ...	1	121	121		22 11 0	*6 7 9*	At auction at Rs. 252.
4	Bagalkot ...	Bagalkot ...	Bagalkot Association.	Dharwar No. 1.	1½	263	175⅓	27·8	29 3 7	2 8 5	Private sale at Rs. 225 per Naga.
	Do. ...	Do. ...	Do.	Kumpta Ordinary.	1½	286	190⅔	25·9	31 12 0		
5	Sirur ...	Do. ...	Do.	Dharwar No. 1.	1	115	115	28·1	19 2 10	1 3 10	
	Do. ...	Do. ...	Do.	Kumpta Ordinary.	1	107	107	26·4	17 15 0		

28. While recommending the substitution of Dharwar No. 1 for the Local Kumpta all over the Kumpta tract, it was presumed that the former was superior to the latter in the following respects:—

(1) It has a larger staple (undoubted).

(2) It gives better yield than the local Kumpta (this has not held good all over wherever it was introduced. Further comparative trials are in progress).

(3) Its ginning percentage is 28 per cent. while that of ordinary Kumpta was only between 25 and 26 per cent.

(4) It is an early variety and the collection of Kapas is done in only two pickings, while the local requires three or sometimes four (accepted by cultivators).

29. Thus it was expected that the new type would soon gain popularity over. But on trial by cultivators on field scale, it is found that in certain tracts, where sowing of cotton is thin, its yield is not more than the local cotton. The difference in ginning percentage too, is not very marked in this particular transition tract, where branching variety seems more suited than the new erect type (Dharwar No 1). However, further comparative trials, in cultivators' fields to convince the good results obtained on the Dharwar Farm, are being made, with better method of sowing the cotton with improved seed drills, with heavy seed rate and thinning out the plants afterwards at required distances. It is hoped that by this method, in which there would be greater number of plants at regular distances, the new type would yield more than the local, and would be popular.

30. The following statement shows the details of percentage of lint of different kinds of cottons grown in this Division on field scale by cultivators, and the prices obtained in the auction sale held at Hubli by the Co-operative Cotton Sale Society. The ginning percentages were found out under the supervision of the Cotton Superintendent (Mr. Dharwarkar) and his District staffs. :—

Variety.	Class.	Lot No.	Approximate average per cent. of lint to cotton.	Approximate average quantity of lint to Kapas per Naga.		Number of Docras in each class.	Remarks: Price realized in Auction per Naga.
Broach ...	I		33·0	15	21	5	315
Upland ...	I & II		33·0	15	21	16	300
Cambodia ...	I		36·0	17	7	82	265
Do. ...	II		35·0	16	21	300	230
Do. ...	III		34·0	16	7	234	200
Do. ...	IV		33·0	15	14	95	191
Do. ...	Rejected					54	160
Kumpta Cross ...	I		30·5	14	7	64	291
Do. ...	II		29·2	14		10	285
K. Selected ...	I		28·1	13	14	190	281
Do. ...	II		27 & above.	13		58	270
K. Ordinary ...	Kurdur Lot.		27·6	13	6	301	269
Do. ...	Hosaritti Lot		27·6	13	6	279	266
Do. ...	Shirampur Lot.		27·6	13	6	311	265
Dharwar side ...	Lot	A	27·1	13		224	268
Do. ...		B	27·1	13		191	269
Do. ...		C	27·1	13		364	263

31. From the statement above it will be seen that there is not marked difference in the percentage of lint in the selected and local types as grown by cultivators on field scale. But in Farm samples, this difference is always very great. It may perhaps be due to the extent of leaf in cultivators cotton of local type.

32. The difference in the rates obtained for the selected and ordinary Kumpta in the above statement, *viz.*, Rs. 281 and Rs. 263, seems to be entirely for the superior staple of the former. Messrs. Tata & Sons of Bombay always give a valuation of about Rs. 20 more, per Kandy for the selected type, than the average ordinary Kumpta sample in Bombay for that year. This extra value for quality, together with the expected price for its higher ginning percentage, *viz.*, $1\frac{1}{2}$ to 2 per cent. over the ordinary Kumpta, works out at a premium of about Rs. 25 per Naga (produce of 4 acres) in favour of the selected type, provided the yield of both the selected and the ordinary, are the same per acre. The premium would be greater in proportion to its higher yield per acre over the local cotton.

33. In the mill test made at the Gokak Mill 3 years ago, only a general opinion was expressed about the good quality of selected type. The opinion then expressed ran as follows :—

"The cotton was considerably superior to any of the Kumpta Cottons as supplied either direct or by rayats or which we have obtained from the near market. It is bright, light, clean, long in staple and uniform and of middling strength. From it we spun three counts, *viz.*:— 20s, 30s, 40s and the yarn ran smoothly and demanded very little attention from the work people, and we would no doubt have received better results, had we had sufficient cotton to make it worth our while to alter our machinery, so that it would be spun into yarn under the best conditions."

34. To have an accurate idea on the mill test of different varieties of cottons, grown in the Division, the Cotton Superintendent arranged to supply the Hubli Mills with sufficient quantity of lint of the different varieties. From the statement given below, it seems that Kumpta-cross stands first in all respects, and there is not much difference in the selected and ordinary Kumpta either in tension or in blow-room loss:—

Name of staple.	Counts.	Test.	Blow-room loss.	Price realised on a Naga of lbs. 1344.	Price for local cotton on bazar on the day.	Difference of profit per Naga.	Remarks.
Kumpta-cross No. 1.	19·8	77	12·10	326	274	52	Very good.
Do. ...	26·14	58	12·10	326	274	52	Very good.
Kumpta-cross No. 2.	17·5	68	14·6	302	274	28	Passable.
Do. ...	25·97	52	14·6	302	274	28	Passable.
Kumpta-cross No. 3.	18·5	72	13·4	302	274	28	Poor.
Do. ...	24·2	63	13·4	302	274	28	Poor.
Selected Kumpta No. 1.	18·0	69	12·10	306	274	32	Fairly good.
Do. ...	28·0	59	12·10	306	274	32	Do.
K. Ordinary No. 1...	18·6	77	12·10	286	274	12	Do.
Do. ...	29·6	45	12·10	286	274	12	Do.
Broach No. 1 ...	17·0	79	7·6	344	274	70	Do.
Do. ...	27·7	44	7·6	344	274	70	Do.
Gadag side Kumpta.	19·7	61	7·6	286	274	12	Do.
Do. ...	27·7	40	7·6	286	274	12	Do.
Cambodia special from Gadag Society.	19·23	69	8·4	345	281	64	Good for 20s and poor for 30s.
Do. ...	29·41	36	8·4	345	281	64	Do.

Test.—Yarn one league 120 Yds. with standing pressure of lbs.
For 30s. 45 to 60 lbs. Test is good.
For 20s. 70 to 75 lbs. Test is good.

35. The thinning and spacing experiments in Dharwar No. 1 were repeated during the year on the Dharwar Farm on 10 guntha plots to confirm the results of last year. The results as obtained are given below:—

Pot No.	Name of type G.	Spacing.	Yield of Kapas per acre lbs.	Ginning percentage.
641-642	Dharwar No. 1 ...	24″ X 9″ unpruned.	539	27·6
639-640	Do. ...	24″ X 12″ unpruned.	560	27·6
637-638	Do. ...	24″ X 12″ pruned.	500	27·6

36. The distance of 12″ between the plants in the row has given slightly higher outturn than 9″. But the difference in the outturn, *viz.*, lbs. 21, seems negligible. It can thus be concluded that any distance between the plants in the row from 9″ to 12″ for Dharwar No. 1 is suitable to get the maximum crop.

37. *Gadag No. 1.*—The superiority of Gadag No. 1 (Upland Type) is well established both in its quality and quantity per acre. Both the buyers and the growers are satisfied. There is large demand for pure seed of this variety and arrangements are being made to grow them, as far as possible, through registered seed growers. Extension of the Gadag Farm to grow sufficient seed of our own, of Gadag No. 1 is under contemplation. It is hoped that with a sufficiently large quantity of our own pure seed, we would be able, through the help of reliable seed growers and Co-operative Seed Societies, to supplant the mixed type all over the Dharwar-American tract and substitute this new type of Upland for it.

38. *Cambodia.*—There has been a very serious deterioration in the quality of this cotton. Mill buyers have altogether stopped buying this variety during the current year. Any demand for this cotton, is from middlemen only who sometimes pay good prices, owing to its higher ginning outturn and good colour. It is only used for mixing purposes with other inferior kinds to make the whole thing of a better class.

39. The following are the remarks on mill tests taken by Messrs. Tata, Sons & Co. at Nagpur Mills:—

Kind of test.	Gadag Cambodia.	Yeotmal Buri.	Lyalalpur American.	Umari.
Blow-room loss ...	9·23	11·70	10·34	12·29
Tension ...	58	67	70	78
Price calculated per Naga ...	270	260	253	250

40. *Broach.*—As early rains are uncertain, no encouragement is given to this cotton which requires to be sown about a month and a half earlier than the local cotton. Yet it is surviving in some places as the cultivators find it suitable for their condition. However it will soon disappear.

41. *Kumpta Cross (Dharwar No. 3).*—Though the area under this cotton was restricted so far to a limited tract between Dharwar and Belgaum Districts, its popularity is becoming wider, owing to its superior qualities, *viz.*, yield, ginning outturn, strength of staple and colour, &c. The buyers especially the mill owners are in great favour for this variety. They consider this to be the next to Broach in quality. Pure seed of this cross cotton is produced on the Gokak Farm and supplied to one village in the Dharwar Taluka for multiplication. The Co-operative Seed Societies are purchasing and distributing the seed among cultivators who specially wish to grow this variety. This type seems to have great future for it though the area for it does not seem to be very great.

Experiments by District Staff.

42. A few experiments with top dressing of oil cake on the staple crops were arranged by the District staff and the results seem to be encouraging and are given below:—

Crop.	Treatment.	Yield per acre.
		lbs.
Jawar ...	Ordinary ...	1,568
Jawar ...	Top-dressing of lbs. 480 of cake per acre.	2,700
Spelt wheat ...	Ordinary ...	2,016
Do. ...	Trop-dressing of lbs. 480 of cake per acre.	3,024

43. The results of top dressing experiments on rice with Karanj cake arranged at Mugatkhan-Hubli in the Belgaum District are summarised below:—

Kind and quantity of manure per acre.	Cost of cultivation per acre	Yield per acre.	Value of grain.	Net profit per acre.
	Rs.	lbs.	Rs.	Rs.
F. Y. Manure 5 carts ...	32	1,620		58
F. Y. Manure 5 carts+ lbs. 280 of Karanj cake.	42	2,160		8

44. It is gratifying to note that the use of cake manure for food crops is being appreciated by cultivators in the Sholapur and Belgaum Districts.

Vernacular Agricultural School, Devihosur.

45. The initial difficulty of securing boys to the school has almost been now overcome. To secure the right sort of boys to the school, attempts are being made to admit students after personal interview wherever possible. There were 28 boys on the roll, of whom one left the school at the end of the past term, thus leaving 27 students for the full year. Of these 14 were in the first year and 13 in the second year.

46. Arranged according to District, they stand as under:—

Serial No.	Name of District.	First year No. of students.	Second year No. of students.
1	Dharwar ...	9	9
2	Belgaum ...	5	2
3	Bijapur ...	0	2
	Total ...	14	13

Arranged according to caste they stand as below:—

Serial No.	Caste.	1st year.	2nd year.	Remarks.
1	Brahmin ...	7	5	
2	Lingayat ...	7	6	
3	Raddi ...	0	2	

47. Of the 27 boys, 4 were detained from appearing for the annual examination, owing to great unpunctuality in attendence. Thus 23 boys appeared for the annual examination of whom 12 in the first and 11 in the second year. Out of the 11 in the second year, 10 passed with credit, securing 60 per cent. marks, the standard laid down for Kulkarniki Examination, in lieu of the Vernacular School Final Examination.

48. An additional area of 7 acres and 20 gunthas was taken up on lease, for further practical training of a few students for the third year. Only two boys remained for this training. It is yet to be seen, how this extra training becomes popular.

49. A special gathering was arranged at the end of the year and Mr. K. B. Bhadrapur, Personal Assistant to the Registrar, Co-operative Society, addressed the students. The gathering was well attended by parents of students.

50. Acknowledgments are due to various gentlemen who have helped the school in a variety of ways. Amongst these the trustees of Sir David Sasoon Trust Fund Committee deserves special mention. Rao Saheb Shetti has continued his benevolence by a further grant of land to the school.

Tegur Farm.

51. Rainfall during the year was good and grass on this farm, as elsewhere in Mallad, grew also well. Owing to late rains, in October and November, haymaking was done rather late, after removing the heads of spear grass, by the comb specially made for it. Attempts were also made to make hay at proper time during short breaks of rain. But the hay made was all spoiled. Hence the opertion was to be stopped till December. However, owing to late rains the grass remained in green condition for a longer time than usual. Thus the hay made, though late, was of a fairly good quality.

52. As stated in last year's report a fairly large quantity of cultivated fodder such as jawar of different varieties, kulthi and rice straw, were grown on the farm to supplement the grass fodder. Ensilage from grass and wagar variety of jawar was made to the extent of lbs. 35,000. The other dry fodders (grass and jawar, &c.) produced on the Farm amounted to lbs. 1,36,000. It will thus be seen that a large quantity of hay and fodder is produced on the farm and reserved for emergency in a bad season.

53. Amongst the various varieties of grasses grown under different conditions of land and cultivation on the Farm, Pavanya (*inchoemum sulcatum*), Gejjegadde (*anthesteria ciliata*) on top lands, and Marvel (*andropogon annulatus*) in low lying patches seem to have chance of success. Marvel establishes earlier by planting stools than by broad casting seeds. Attempts are being made to establish a Marvel plot of grass by regular weeding of other local varieties of grasses, especially the spear variety, which come in through various sources. To prevent the seed of other varieties creeping in through rainwater, small drains are dug round the Marvel plot. Thus a pure Marvel plot is established by artificial means, and another is now taken in hand.

54. The great inconvenience that was felt in storing the large amount of fodder raised on the Farm, and the consequent loss in storage, is now removed by the large Dutch Barn transferred from Ranebennur, from the Steam Plough stock.

55. With all the arrangements made for stocking fodders of different kinds, and the care taken of the animals in housing, giving water and fodder at regular times, it is found that the condition of cattle does not remain satisfactory during the months of April, May and June, especially of cows of middle and old age with calves at foot. Young stock remain in fair condition. Experience of last seven or eight years shows, that breeding good cattle in Mallad is not possible with mere substitution of good bulls for the local ones. Good fodder and concentrated food are necessary to maintain the condition of cattle in general in the hot weather, and particularly of the growing young stock from superior sire.

56. The following is the statement of cattle on hand on 31st March 1920: —

Serial No.	Name of cattle.	On hand on 1-4-19.	Purchased in 1919-20.	Born in 1919-20.	Transferred from Bull or Cow calves.	Total of Columns 4 to 6.	Total of Columns 3 and 7.	Deaths in 1919-20.	Sold in 1919-20.	Transferred to other farms or otherwise disposed.	Total of Columns 9 to 11.	Total disposal.	Balance on hand on 31-3-1920.	Valuation on 31-3-1920.
														Rs.
1	Bull ...	1					1						1	240
2	Bullocks ...	2					2						2	130
3	Cows ...	38	1 Stray.		2	3	41	2	4		6	6	35	721
4	Bull calves...	26		9		9	35	2	2	2	6	6	29	692
5	Cow calves...	34		7		7	41	1		2	3	3	38	674
	Total ...	101	1	16	2	19	120	5	6	4	15	15	105	2,457

57. From the statement it will be seen that the increase in the stock during the year is not very appreciable. This is due to the higher percentage of death and the lower percentage of production.

Agricultural Association.

58. The District Agricultural Associations of Dharwar, Bijapur and Belgaum have continued to do useful work of selling and hiring of improved agricultural implements especially ploughs. The Kanarese Agricultural Magazine published by the Dharwar Association by a special publishing committee, consisting mostly of the Farm Staff at Dharwar, is a popular medium for infusing agricultural information among the educated cultivators. Various enquiries, on different subjects, after reading the articles are being received, which are sent for disposal to the different heads of sections.

59. The Dharwar Association is having its own building in the town to stock the large number of implements it has for hire, and the large quantity of seed it has to handle in the season.

60. Among the Taluka Associations, Chikodi and Athani are doing useful work. A new Taluka Association of Saudatti is registered during the year. There are some energetic members in this association. It is hoped that this association will be of great help to the Department in the propagandistic work in that part, especially of implements and the improved types of cotton.

61. The death of Mr. Gopalrao Savanur, Joint Honorary Secretary of the Belgaum Association is very much regretted. Any progress made by the Belgaum Association during the last three years in its work, especially in the eradication of grass hoppers, was due to Mr. Savanur's personal efforts.

62. The various honorary members of the different associations in the Division have discharged their duties most satisfactorily.

Publication of Bulletins and Leaflets.

63. The following leaflets and bulletins were published during the year:—

(1) Cultivation of Onion for seed by Mr. I. S. Kulkarni.

(2) Hand tools to remove thorns from prickly-pear leaves by Rao Saheb M. L. Kulkarni (is sent for publication).

Besides the above Mr. S. S. Salimath, Inspector of Agriculture read a paper on "Gonag" a weed in drilled paddy at the Science Congress held at Nagpur.

Experimental Results.

64. These are given in full details in the different reports submitted by the respective Heads of Sections. Among these the work undertaken by Mr. Shevade to find out the best method of putting up bunds, in black soil fields and the breeding work of cotton and wheat by Mr. Kottur are of great importance.

Establishment.

65. All Heads of Sections with their subordinates both on the Farms and in the Districts have shown zeal and enthusiasm in finding out new problems for investigation on agricultural stations, and in carrying the improvements to cultivators in distant parts.

M. L. KULKARNI,

Ag. Deputy Director of Agriculture,
S. D., Dharwar.

APPENDIX F.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, KONKAN, DURING THE YEAR 1919-20.

Lines of Work.

The work of the year 1919-20 has proceeded and developed along the same main lines as in the past, namely :—

(1) Experimental and research work including investigations into new possibilities ;

(2) Extension work or popularization and introduction of improvements into the practice of agriculturists ;

(3) Agricultural education.

2. The following are the broad features of the further development during the year of the organisation for carrying out the work on the above lines :—

The Rice Research has had its independent station at Karjat well started and a provision for one graduate assistant to the Rice Specialist has been approved by Government.

Arrangement was made to provide Ratnagiri Farm with a graduate to fill up its new sanctioned post of an assistant, but he had to be taken away at the end of the year precluding the possibility of starting work at the *varkas* Sub-station at Hatkhamba the land for which has already come in our possession.

The contemplated expansion of the Kumta Agricultural Station to include cocoanut investigations has similarly been arrested for want of a graduate to fill up the additional post sanctioned.

It has been possible to resume propaganda work in the Thana District, an incumbent to fill up the vacant post having been available, while the same in the Kolaba District had to be suspended for want of a suitable man.

The institution of the posts of Kamgars of which three have been allotted to this division will prove of immence value for carrying out effective propaganda work far and wide amongst the agriculturists.

Staff.

3. The staff available for responsible work in the Konkan consisted of one Deputy Director of Agriculture and graduate assistants allocated in the following manner :—

Rice Specialist for carrying out scientific researches in Rice cultivation.		1
Experimental stations	...	5 (one of these has had to be transferred to the Agricultural Schools at the end of the year.)
Entomological work	...	1
For extension or propaganda work	...	3 (one of these was available from December only.)
Agricultural Schools	...	2
Total	...	12

One post of the Agricultural Overseer, Kolaba, and two of the graduate assistants for the Kumta and Ratnagiri (from May onwards) agricultural stations have remained vacant as no agricultural graduates have been available to fill them up.

The work of supervising and directing the activities of eleven independent units and of the administration work thereof scattered over four districts very badly communicated has so increased that it has been impossible for the Deputy Director alone to do adequate justice to all without the help of a superior assistant of the rank of the Divisional Superintendent.

It has also been found that the work greatly suffers in the leave vacancies, as there is no one available to take the place of absentees. The need for one supernumerary graduate and one non-graduate to act as leave relievers is imperative.

Physical Conditions influencing the Agriculture of the Year.

4. *Rainfall and Season.*—The rainfall of the year was the most favourable. The total runs up close to the average at Ratnagiri and Alibag and though forty-two inches below the average at Kumta by the fact of its timely distributed precipitation resulted into bumper yields of rice and gave normal condition to the *varkas*, *rabi* and irrigated croppings.

The year was peculiarly free from the infestations of the stem borer on rice particularly at Ratnagiri where it had been so rampant during the previous three years. There were also no other insect-pests of any significance.

In the matter of fungus diseases, the *koleroga* appeared in a very mild form in Kanara; the wilt disease on onions, however, continued in all its seriousness.

The following comparative figures of the average outturns per acre of the principal crops calculated from the whole area under cultivation on the three farms representing three different conditions for the last two years as well as for the year when the average was the highest in the history of the three farms will give a clearer idea of the combined effect of the above conditions :—

Farm and Crops.	Average outturn per acre.			
	1919-20.	1918-19.	The last best year for the crop in the history of the farm.	
			Year.	Outturn.
	lbs.	lbs.		lbs.
Alibag Farm (Kolaba District).				
Rice ...	2,437	1,434	1912-13	2,719
Nagli ...	791	515	1914-15	1,354
Ratnagiri Farm (Ratnagiri District).				
Rice, upland ...	2,325	490	1915-16	2,032
Rice, lowland ...	2,695	1,383	1915-16	2,360
Kulith (in the *rabi* season in the lowlying rice lands).	320	430	1916-17	560
Kumta Farm (Kanara District).				
Rice, upland ...	1,680	310	1919-20	1,680
Rice, lowland ...	1,900	1,420	1919-20	1,900

Experimental Work.

5. For carrying out the experimental and investigation work we have now four stations as follows :—

(1) Alibag, (2) Ratnagiri, (3) Kumta, and (4) Karjat Rice Research.

Some simple tests were also carried out in the districts under the immediate direction and supervision of the propaganda staff.

The most salient features of the findings of the year are summarised below section by section.

Rice.

6. Improvement of this crop occupies a main and prominent position in the programme of work at all the four stations mentioned above. The various directions in which improvement is being sought for with the results achieved during the year are indicated in giving the following summary.

I. Raising of Seedlings.

7. *Manuring.*—The good results of substitutes and supplements to *rab* were confirmed. Farm yard manure in quantities representing those burnt in *rabbing* an equal area was included in the experiment at the Ratnagiri Farm with the result that it has been found to compete fairly well with *rab* at a less cost.

In Kanara where there is no practice of *rabbing*, it was tried as a curiosity and was found to give the best seedlings yielding the heaviest yield as compared to the local method of manuring. The increase due to concentrates like fish and *undi* cake is much less than the 50 per cent. of the last year.

8. *Seed-Rate.*—At Kumta halving the seed-rate has not affected the area to be transplanted or the final yield, but at Ratnagiri, the results are not as favourable.

9. *Method of Sowing.*—At Kumta, three methods, (1) starting the seedlings in May under irrigation, (2) sowing in the dry soil just before the monsoon, and (3) sowing of sprouted seed in a puddled field some days after the beginning of the monsoon were compared. The first and the third which were equal with each other were both found to be superior to the second, as was also the case in the previous year.

II. Field Manuring.

10. *Green Manuring.*—All the results as summarised in the last report showing the limited scope for green manuring with crops of *san* and *dhaincha* but decided advantages with green leaves and tender twigs of *karanj* and *rui* the latter maintaining an increase over 40 per cent. on the Ratnagiri Farm, were confirmed and the experiments concluded except at Kumta where green or dry leaves have not shown as distinct an advantage during the last two years, the experiment has been in progress.

11. *Bulky Manures.*—On the Alibag and Ratnagiri Farms the residual effects of the several manures the trial of which had been concluded two years ago as beneficial are being watched. The residual effects of *mowra* refuse and rice hulls on the Alibag Farm are still over 35 per cent., while on the Ratnagiri Farm the results being contradictory in the duplicates nothing definite can be said. The residual effect of the heavy dose of night soil applied three years ago at the Ratnagiri Farm appears to have disappeared.

Referring to the direct effect of manures which were applied during the year it is very curious that neither fresh night soil nor poudrette supplying lbs. 20 of nitrogen seem to have been beneficial at the Ratnagiri Farm, though poudrette on the Alibag Farm has been responsible for an increase of 28 per cent.; at the latter place sheep folding at a cost of Rs. 40 per acre has increased the yield by 72 per cent. which is worth Rs. 55 at the current rates of paddy. On the Kumta Farm dry and green leaf from forests either used as such or as litter being compared with farm yard manure or between themselves do not show superiority for green leaf over the dry one, the dry leaf used as litter having been found to be the best.

12. *Concentrated Manures.*—The experiments at Alibag and Ratnagiri having been concluded two years ago as being unmistakeably and substantially profitable, the residual effects are under observation. On the Alibag Farm in the case of *karanj* cake not only there is no residual effect noticeable even in the first year after its discontinuance, but there is a depression of yield in grain though a distinct increase in the outturn of straw in the plots that had been manured; fish manure plots receiving varying quantities of manure which yielded evenly in the first year after its discontinuance show small increases for the increased quantities in the second year. On the Ratnagiri Farm, however, the residual effect of *undi* cake is very marked, while that of fish is doubtful. Sulphate of ammonia shows no residue both on the Alibag and Ratnagiri Farms. As regards the residual effect of bone meal, on the Ratnagiri Farm though reduced as compared with that of the last year it is yet marked varying from 15 to 20 per cent., while the same on the Alibag Farm has almost disappeared.

The Kumta Farm being only started recently, the direct effects of all the above manures are yet being tested. Bone meal leads all just as was the case in the previous year; this year, however, the increase in grain amounts to only 45 per cent. as against 100 per cent. of the previous year, though the increase in straw remains the same as last year, *viz.*, 200 per cent. It is very curious that while fish manure had effected an increase of over 50 per cent. during the last year, which was one of very low rainfall, it shows absolutely no increase during this year of good rainfall. Other nitrogenous manures, *undi* cake, ammonium sulphate, have behaved similarly. These results confirm, therefore, the view put forth last year that it is the forms of nitrogen and phosphoric acid such as are present in bone-meal which the Kanara soils most respond to for their rice crop.

Rock phosphate which did not show any benefit on any of the three farms last year has in its second application shown an increase at all the three farms varying from 12 per cent. at Alibag to 20 per cent., at Kumta, Ratnagiri being somewhere intermediate between the two. Addition of green matter to rock phosphate did not enhance the effect of the latter.

13. *Indirect Manures.*—Lime at Ratnagiri applied four years ago still continues to show an advantage; at Kumta in this year of its first application there has been no benefit. Salt which had shown distinct advantages on red laterite soils of Ratnagiri and only slight on the black soils of Alibag has not shown any at Kumta; at Ratnagiri even the residual effect of this has been distinct.

III. Cultural.

14. *Ploughing.*—Exposing of the soil by breaking up of the land in the fair season has been definitely proved to be of no benefit on the Alibag Farm; the trial has been also taken up at Kumta, where the local practice is of regularly ploughing the rice field in the fair season, with the result that the ploughed field gave a lower yield than the one which was kept unploughed, a result which must be accepted with great reservation unless and until confirmed by future trials.

Ploughing the rice land with meston plough, which inverts the soil has been again found to be of advantage in the low-lying fields both at Alibag and Ratnagiri though at the latter place it did not prove so on the uplands.

15. *Methods of Growing.*—Broadcasting or drilling and sowing *rahu* (sprouted seeds) in a puddle once for all in the fields, and growing of seedlings in nurseries to be eventually transplanted in the fields are practices met with in the rice growing tracts of Konkan. With a view to study the conditions which each practice requires and whether the less laborious and less expensive ones cannot take the place of the most laborious and expensive practice of transplanting, experiments have been taken up on the Ratnagiri and Kumta Farms. On the Ratnagiri Farm on the uplands neither drilling nor transplanting yielded as much as the crop obtained by *rahu* (sprouted seed) sowing which last is the local method of growing rice on the uplands in the Ratnagiri Taluka of the District. But on the Kumta Farm, on lands intermediate between uplands and the very low-lying, broadcasting or drilling yielded within 96 to

98 per cent. of the transplanted crop which last is the most usual practice of growing rice in the southern two talukas of the below ghat portions of the Kanara District; during the previous year also the results were even more decidedly in favour of the former; this is an important result since drilling or broadcasting costs about Rs. 15 per acre less for labour.

16. *Transplanting.*—On the Kumta Farm, with the seedlings prepared with the local manurial treatment, single or double seedlings have been far behind four in a bunch; however, in the case of specially strong seedlings obtained by more manuring and thinner seed-rate, singles and doubles did far better than in the first case this year, and had actually equalled four seedlings last year; eight seedlings either ordinary or specially strong yielded no better than four seedlings.

On the Alibag Farm both in the case of ordinary and strong seedlings when a common distance of 9″ × 9″ was adopted, 16 seedlings in a bunch (the local practice) have yielded the highest outturn in the majority of cases during the past four years in which these experiments have been in progress, but four seedlings have not been far behind and have in one of the duplicate sets of the past two years exceeded the yields from 16 seedlings; one and two strong seedlings have equalled the fours more or less.

These results, therefore, confirm the conclusion drawn in the last report that four strong seedlings in a bunch on the whole is the more profitable and safer number to adopt.

IV. Improvement by Seed Selection.

17. The striking advantage effected by mass selection of seed has been maintained both at Ratnagiri and Kumta Farms.

V. Varieties.

18. On the Alibag Farm amongst the new varieties being tried, *garisal* amongst the early, *dodka* and *mahadya varangal* amongst the medium, and *indrasal* amongst the late have shown up to be superior to the local varieties. This is the second year *mahadya varangal* has been found to be superior to the local *bhadas* and *halva.*

On the Ratnagiri Farm for the low-lying fields *bhadas* and *halva* compete well with the local variety *waksal.*

On the Kumta Farm, *maskati* from South Kanara and *bile-akka* from Karwar compared well with the local ones. The best local varieties from Ratnagiri and Alibag were miserable failures when taken to Kumta.

Researches into Rice Cultivation.

19. In the last year's report, the establishment of a rice research station at Karjat for a further and close scientific study of the requirements of the rice plant has been referred to.

Mr. K. V. Joshi, B.Ag., was in the immediate charge of the studies and investigations. During the year under report much work in the preliminaries of laying out and fitting of the station for investigation work had to be done. The actual work in the direction of research may be said to have consisted of two parts:—

(1) Studies on the life history of the growing rice plant.

(2) Behaviour to changing outside treatments.

The studies under the first part which were commenced in the year 1918-19 at the Alibag Agricultural Station were continued and elaborated and have led to very interesting and instructive further findings in the following aspects:— (1) water requirements at and after sowing; (2) effects of the depth at which

seeds are deposited in sowing; (3) time of sowing; (4) temperature of a germinating mass of seed; (5) quantity of water absorbed for germination; (6) germination and tillering; (7) principles of transplanting and (8) changes in the plant after transplanting including tillering.

The work under second part consisted of studying the effects of varying (1) the vigor or strength of seedling, (2) the age of seedlings in transplanting, (3) the depth of transplanting, (4) the distance of transplanting, (5) the number of seedlings per bunch and (6) the kinds and quantities of manures. The last three of these have also formed the themes of experimentation on the three farms, but the studies at the Research Station are repeated with a view to study the causes underlying the results obtained and to get to know the real requirements.

Such of the results and observations as show a practical bearing are the following:—

(1) That more vigorous seedlings bring about over 30 per cent. increase in yield.

(2) The best age of seedlings of *kolamba* variety of rice for transplanting is from 23 to 27 days under the Karjat conditions of soil and climate, more or less ages give reduced outturns, though 18 days and 34 days are not very much behind; that the thicker sowing in the seed bed hastens this stage, which factor may be taken advantage of for adjusting the work of transplanting.

(3) Transplanting seedlings as near the soil surface as practicable is to be recommended.

(4) For about a week or 10 days after transplanting the optimum depth of water in the fields should be half an inch.

(5) Tillering is very largely influenced by the amount of space given round each bunch, but the number of ear bearing tillers is not in proportion of the space ratio. The point at which the best advantage, as judged by the yield per acre, is secured is a distance of $12'' \times 12''$ for six culms in a bunch under conditions similar to those of Karjat.

(6) Out of the inorganic forms of nitrogen tried, namely, nitrate of soda, sulphate of ammonia and nitrate of potash, sulphate of ammonia has given the best results and nitrate of soda is absolutely without any effect. Addition of potash is not at all responded to.

Profitable Crops in place of and for Rotation with Rice.

20. *Belgaum Rice Land Jawar mixed with Rice.*—This practice which is very common on Belgaum side in places of moderate rainfall was tried at Malgi in Mundgod Peta of the Kanara District representing similar conditions with encouraging results.

21. *Jute.*—This is the only crop which is known to be thriving in Bengal under conditions of rice growing as an alternative to rice. This was tried on all the three farms and it was found that as a start to the crop under light conditions of rainfall, as seems necessary to the crop in its early growth, cannot be given in Konkan which does not receive such anti-monsoon rains, and as the crops sown with the advent of the monsoon cannot be made to thrive under its sudden, heavy, and constant downpours there is very little chance of success. Moreover, the laterite soils of the Southern Konkan are found too poor to make even high manuring pay.

22. *Other Crops.*—In Kanara it is found that the rice crop in the *makki* (uplands) lands which are well drained do not now yield paying crops of rice owing to the changed conditions of manure supply With a view to see if any other crops would not be more profitable on such lands, several crops are being tested on the Kumta Farm. Out of *ragi*, *vari*, *jawar*, *udid*, *tur*, groundnut and chillies that were tried, *vari* and groundnut only competed well with and gave slightly more returns than rice. *Vari* which was almost unknown in this

district particularly caught the fancy of the tenant cultivators and many have furnished themselves with seed for trial next year.

How to crop Rice Lands if the Season does not admit of timely Cultivation of Rice.

23. Such a state of conditions had occurred in the year 1918, and the Agricultural Department had no experimental data on which to base their recommendations. So experiments have been instituted on the Alibag Farm. Two lines of attack have been adopted, namely, (1) if rice cultivation can be resorted to if the season becomes favourable later on and (2) what other crops can be grown:—

(1) Under these two methods—(*a*) up to what time the normally sown seedlings can be used with prospects of fair yields and (*b*) sowing early varieties of rice late in the season by *rahu* (sprouted seed) method either in the field itself or for the purpose of transplanting—were tested with the following results:—

(*a*) Seedlings transplanted up to the middle of August yielded only about 5 per cent. less than the normally transplanted ones. By the next fortnight, the yield was lowered to 60 per cent. while during the next three weeks the yield was only 15 per cent. This shows that the first sown seedlings if kept up living may be expected to yield fairly even if transplantation is delayed to the beginning of September, and that it would not be worth while to transplant later than that.

(*b*) Fresh sowings with *rahu* of an early variety in early rice fields in the second week of August yielded half of the usual variety timely transplanted.

(2) Several crops were tried on a row scale in late rice fields as well as in early rice fields both on ridges and flats, but owing to water saturation brought about by a normal season all of them failed.

Rabi (dry) Cropping of the Moisture-retentive Rice Fields.

24. *Improvements in the existing Crops.*—Drilling of *kulith* (*dolichos biflorus*) has not as also in the previous year shown any advantage on the Ratnagiri Farm.

25. *New Crops.*—On the Ratnagiri Farm, groundnut which was found in the past two years, to be very promising in the preliminary small trials was grown on a plot scale and found to give a fair yield of nuts and a good quantity of green vines which brought in not less than double the money return of that from *kulith*, the local crop. Out of others which were repeated, still on a row scale, sweet potato is remarkably promising and will be tried on a field scale; soybean is another crop showing forward.

Similar trials have been undertaken on the Kumta Farm, but the soil of the plot where this was done was found too poor; still groundnut and soybeans were marked out to hold out better than the rest.

Irrigation Farming.

26. *Improvements in the existing Crops.*—This includes work on sugarcane or on the newly introduced crops of onions, chillies and sweet potatoes.

27. *Sugarcane.*—In point of varieties, striped Mauritius, Red sport, Manjav which were noted as distinctly early varieties in the last report very nearly approach the yield of Red Mauritius which is the accepted variety at present. On the Kumta Farm it has been noticed that the local variety *daskabbu* tillers more and gives a larger number of canes per acre than Red Mauritius, but the latter owing to increased weight per cane and the richness

of juice has in ultimate yield proved superior to the former; here Manjav has even surpassed Red Mauritius, and Barbados is another which has yielded even more than Manjav. It is to be seen whether these varieties maintain their superiority in future trials. Pundhia was again very seriously affected by red rot and this variety has been definitely abandoned as unsuitable for Konkan.

As regards manuring, concentrated manure like fish, oil cake and ammonium sulphate have again proved profitable on the Kumta Farm; replacing half the quantity of farm yard manure as locally applied with *karanj* cake in the case of Red Mauritius and fish in the case of local variety *daskabbu* have proved to be the best.

Introduction of New Crops.

28. *Onions.*—This, a valuable new crop being successfully introduced in the Kanara and the Ratnagiri Districts, has been faring very badly on account of the wilt (microsporium sp.) disease. The investigation of remedial measures has been taken in hand.

29. *Sweet Potatoes.*—This has again maintained its high yields and profits during all the seasons of the year on the Ratnagiri Farm. This is a crop that every household of a cultivator should develop a taste for, so that it could be made use of for substantially increasing the output of food products from this part of the country.

30. *Cabbage.*—This crop has been found to grow well along the coast, but the defect has been that the leaves instead of forming a head, spread out. On the Ratnagiri Farm, a spraying with 5 per cent. solution of common salt was found marvellously effective for overcoming the defect.

31. *Tobacco.*—This crop is being grown on an extensive scale in Malbar in rice fields in the *rabi* season, but is quite unknown in the adjoining district of North Kanara where conditions appear to be similar. The trial of this crop has therefore been taken up on the Kumta Farm with every sign of success.

Varkas Land Cultivation.

The experimental work was confined mostly to the Bandhan *varkas* substation of Alibag.

32. *Terracing and Levelling.*—The heights of the embankments of the terraces in rectangular plots were raised as found necessary. Devices to catch as much silt as possible from wash-channels and to use it in levelling the adjoining plots are being provided.

33. *Improvements in the existing Crops—Nagli.*—Green manuring with *san* which had been concluded as distinctly advantageous, has shown also a very marked residual effect in the first year after its discontinuance. Manuring with bone-meal and *karanj* cake is also promising.

34. *Introduction of more remunerative new crops—Groundnut.*—The spread of this valuable crop, to which Konkan *varkas* soils and climate have been found to be admirably suitable is handicapped owing to the damage done by crows, wild pigs, jackals, &c. The last two can be kept off by fencing but the first one has defied all devices of scaring them away. It is being now seen whether a tall and spreading crop to screen the groundnut crop from the view of the crows will be in any way effective; with this view a mixture of groundnut and *tur* was adopted, and though the distance given to *tur* was found to be too wide to screen the entire crop, some advantage was noticeable; the trial will be repeated with a lesser distance.

Hill paddy, sweet potato, kanghar, bhendi, all did well as in previous years and can be now considered as conclusively suitable. Hill paddy on *varkas* lands may be expected to give a yield of lbs. 800 without manure.

Chavali seems to be very promising.

Chillies did not fare so well in the last two years as formerly. *Tur* makes a good vegetatible growth but yields poorly.

35. *Planting of Varkas Lands with Economic Trees.*—Several kinds have been or being planted. The rate of survivals is good. At Bandhan cashew-nuts have begun to bear, grafted mangoes are doing well, bamboos are well established.

36. *Establishing a Plantation of Rui* (*calatropis gigantea*).—The green matter from this perennial shrub having been found to substantially increase the outturns of rice, attempts have been started to establish a plantation on the hill and waste lands. It has been found on the Ratnagiri farm that a plantation can be easily established by planting cuttings.

37. *How to bring under cultivation laterite rock plateaux uplands in the Ratnagiri District.*—There is a vast country of such uplands ten to fifteen miles wide and running almost the whole length of the coast line of the Ratnagiri District, which is merely bare rock and produces nothing. It is however noticed that in hollows or quarry beds rice can be grown. To see, therefore, how far attempts to cut out rice fields in this plateaux would be possible and economic on a field scale, a small experiment on a plot of 48 feet by 27 feet was made on the sheet plateaux near Ratnagiri. Building stones were quarried out to a depth of about one foot and the area by a slight levelling of the bottom was converted into something like a tank. The fine debris that was obtained in quarrying was sufficient to fill half the area, the other half being filled by soil transferred from other places such as hollows, &c. The whole process cost Rs. 100, or Rs. 3,200 per acre, out of which the quarried stones returned about half.

The field thus prepared was cropped with transplanted rice and yielded at the rate of lbs. 3,000 of paddy grain and lbs. 4,400 straw per acre, in the portion where good soil was put in and lbs. 2,200 of paddy grain and lbs. 3,300 of straw in the portion where fresh undecomposed debris made up the soil. The whole plot was manured at the rate of 10 cart-loads of cow-dung.

The net cost of making such fields is no doubt very great, but the outturns are also very remarkable. That even the undecomposed debris should be able to produce such a heavy crop is indeed a matter for surprise. Of course, the year of the experiment was an exceptionally good one in respect of rainfall and season.

The further behaviour of the plot will be watched with interest.

Improvement of Fodder Supply.

38. *Cultivated Fodder Crops.*—Lucerne continued to give good yields on the Ratnagiri Farm a dressing of superphosphate being found to have given a substantial increase a second time. Curiously enough it has not yet been possible to grow this crop with success on the Kumta Farm.

Shevri (*Sesbania Egyptiaca*) has done extremely well on the Ratnagiri Farm.

39. *Ensilage.*—Ensilage of grass was continued in *kacha* pits on the Ratnagiri and Alibag Farms with usual success.

Improvement of Water Supply.

40. This year a bore was taken at Hatkhamba ten miles east of Ratnagiri on a hill slope; water was first struck at 72 feet which was only capable of rising by 8 feet, when the bore was continued another current has been struck at a depth of 92 feet, which has a better head than the first one; it is intended to go up to a depth of 200 feet.

Improvement of Cattle.

41. *Use of Milk Animals for Work.*—A pair of she-buffaloes which has been kept on the Ratnagiri Farm to see how far the dual purpose of supplying milk and work can be achieved was continued. They were gradually broken into doing regular field work whenever there was any, including that of working

round and round on the noria water-lift. Both of them kept good and blooming condition of health. One of them which was reported to have been pregnant calved in September last and has given a normal milk yield; of course, she had to be given sufficient concentrated food to compensate for her both functions. The other buffalo which had aborted, was pregnant and aborted again.

42. *Improving the Milk Breed.*—The maintenance of breeding buffalo bulls of the renowned milk breed—*Surti*—for the benefit of the neighbouring she-buffalo keepers, has been continued at all the three farms.

Improvements in Agricultural Implements, Machinery and Appliances.

43. *Spring Tooth Cultivator for Puddling Rice Fields.*—This was worked up by Mr. M. R. Gokarn, Agricultural Overseer, Kanara, from a model he saw in the Mysore State. It consists of two rows of spring teeth fixed alternately one in front of the other in a wooden head-piece and can be worked easily by a pair of Konkan bullocks. It has been found to be more economic for puddling the rice fields in Kanara and Alibag in partially replacing the ploughing. It costs Rs. 15.

Entomological Work.

44. A continuation of the studies of the pests on rice, mango and cocoanut formed the primary lines of work of the Entomological Assistant. The groundnut bug and storing methods also received his attention incidentally. The following are the most important features of the results obtained.

Rice Pests.

45. *Stem-borer.*—With the intention of ascertaining the weak points in the life history of the stem-borers particularly the *schinobius bipunctifer*, at which it can be hit for remedial measures, the rice crops on the Ratnagiri Farm were kept under close and continuous watch throughout the four months of the growing season but unfortunately for the Entomologist and fortunately for the cultivators no borers appeared at all on the farm or in the neighbourhood.

On learning however that some borer attack was noticeable on the Alibag Farm, the Entomological Assistant moved to that place with a view to collect observations on the rice crops there, which usually ripen later than at Ratnagiri. Here he could observe (1) that there seem to be two periods for the two kinds of borers *schinobius* and *chilo* or *diatra*, (2) the maximum number of caterpillars that hibernate in a bunch and (3) confirm the predisposing causes of attack due to manuring and shade.

Mango Pests.

46. *Hoppers.*—Systematic trials of medicines for spraying were made. It was found that crude oil emulsion was not so effective, whereas fish oil resin soap was quite satisfactory. In the attempts to determine the optimum strengths, 1, 2 and 3 per cent. solutions in the case of fish oil rasin soap were all found to have killed the insects, though in the case of crude oil emulsion on the other hand 1 per cent. proved very weak, 2 per cent. was to a great extent effective and 3 per cent. though completely effective seemed to damage the blossom itself.

A tree of 20 feet height and 10 feet expanse required 8 to 10 gallons of liquid to thoroughly spray the plant.

Cocoanut Pests.

47. *Rhinoceros Beetle.*—Remedial measures were tried. Cashew-nut oil was tried in two places with encouraging results. Some cotton rags are to be dipped in the oil and to be kept on the topmost part of the tree in the crown or the axil of the bunch. One pint bottle is sufficient for 100 trees. The results are being worked into a leaflet.

Other Pests.

48. *Groundnut Bug* (aphanus sordidus).—Certain points in the life history of this insect were wanting for the publication of the past studies in the form of a bulletin. This year the appearance of this pest at Bandhan gave this opportunity. The missing link could be found out and the contemplated publication has gone to the press.

49. *Storage Pests.*—The method of storing under sand was verified with *val* (*dolichos lablab*) in tightly sewn double bags and with gram in an earthen jar; in both cases the method did not prove effective.

50. *Miscellaneous.*—Advice was given for controlling the damage by some *bruchids* infesting mango grafts, by *cerambyeid* beetles infesting pomelo tree and by *euproctes* caterpillars infesting the seed-heads of onions.

51. *Other serious Pests that have come to the notice as requiring tackling*—Amongst these in addition to those already in hand are *nal* disease in the Devgad Taluka of the Ratnagiri District and parts of Kanara, *lakhya* (*aleurodidæ*) disease in sugarcane in Ratnagiri, mango files, cocoanut stem weevil (*Rhyncophorus stigmatocotti*), white ants, storage pests, rats and crabs.

This shows how much pressing is the need of increasing the staff of entomological workers in the Konkan.

Protection of Crops from Wild Animals.

52. This question has become very acute in the Kanara district owing to a very large predominance of forests. Such animals are the wild pigs, jackals and wild cats to sugarcane, monkeys to plantains and other garden crops and also sambhars and elephants to some extent. The wild pig however causes the largest amount of loss. Gun licenses are being issued liberally by the Revenue Department and there have been some relaxation in the restrictions of the forest department in respect of hunting, netting and entrapping the wild pig in the forests. Agriculturists have also been resorting to dead wood fences and in some cases mud walls as also to watching by nights. But despite all the above expedients the pest is not efficiently controlled and other more effective devices are being experimented with by the Agricultural Department.

53. *Pig proof woven wire fence.*—The most effective amongst the latter is the use of pig proof woven wire fences. A small experiment has been in progress for the last five years at Killar in Siddapur Taluka of the District with the result that the fence has been quite successful in keeping off the wild pig and can thus save a loss of Rs. 50 to 75 per acre annually in the case of sugarcane crop. The cost per acre at the present prices for these fences for various sizes of blocks comes to the figures shown in the following statement:—

Size of block. Acres.	Cost per acre. Rs.
½	400
1	280
4	140
16	70
64	35
100	28

It will be seen from the above that larger the area in one block, the cheaper it is per acre. In order to derive the largest benefit from this method of protection the fencing must therefore be done on co-operative basis. The Bombay Government have sanctioned funds for the demonstration of this method of protection as widely as possible on co-operative lines.

54. *Village Shikari System.*—This consists in the whole village employing one or more *shikaris* whose business will be to carry out a continuous campaign of destruction of wild pigs and other harmful wild animals. An experiment on these lines has been taken up in a concentrated group of villages in the Honavar Taluka of the Kanara District since last year. The *shikari* gets all the flesh and a contribution in the form of farm produce from almost every cultivator who is in a position to give and has the right over the skins from which it is expected that the cost of ammunition can be defrayed. The guns are at present provided as an experiment by the Agricultural Department, but eventually it is intended that the farming communities will contribute towards the same as their communal property.

During the year under report, with twelve muzzle loading guns and one rifle for killing wild elephants and as many *shikaris* distributed over twelve villages, 150 wild pigs, one panther, and one wild elephant were killed and one more wild elephant was mortally wounded.

55. *Organised Poisoning.*—An experiment in this is under contemplation in a few villages in the Sirsi Taluka of the Kanara District.

Some Special Problems under Investigation.

56. *Manat Land Improvement.*—*Manat* lands are sticky and plastic flat clay lands in the North Konkan, which are mostly barren. The nature and extent of the problem of their improvement has been described in the Annual Report of the Department of Agriculture of the Bombay Presidency for the year 1917-18 on page 65 of Appendix F.

In the direction of improving these lands by changing their texture by the addition of coarse materials—either organic or inorganic, and by drainage, the year's results do not lead any further beyond the previous finding that this method of improvement is of very doubtful value. Underdrainage with tiles has been taken up since the year under report, but the first year's results do not show anything very strikingly.

Experiments to find out if any new and more profitable crops would suit even the existing state of the land were continued. *Shalu jawar* as a *rabi* crop and sugarcane where irrigation would be available have now established their undisputable success. This year's trials show that Borbon or Dharwar American cottons grown as *rabi* crops offer some chance of further progress in this line. As *kharif* crops *tur*, *ambadi*, and *bhendi* even without ridges, while cotton and *jawar* on ridges repeated their promise of success shown last year; groundnut on ridges makes a vegetative growth but pods do not develop properly.

57. *Band disease of the betelnut palm.*—Nothing striking throwing further light on the nature and cause of the disease has come to notice during the year's work.

58. *Curing of Ginger.*—Ginger is grown to some extent in the garden tract of Thana and in a few places in Ratnagiri in which there is also further scope of extension if curing of dry ginger more profitably could be demonstrated. Ginger curing is successfully carried on a commerical scale in Malbar and a small experiment was carried out on the lines followed there with only partial success. It is proposed to depute one of the Assistants to visit Malbar next year to study on the spot all the aspects of the methods of curing as also cultivation and varieties suitable for the same.

59. *The best management of minor forest lands for the supply of Soppu (green leaf) for manure.*—The Forest Department in Kanara have desired the Agricultural Department to investigate into the best methods of management of the minor forest lands in order to make the most of them for the supply of *soppu* for manure in the coastal portion of the district with a view to demonstrate them to the cultivators. An area of 148 acres of such land near the Kumta Farm has been made over to the Agricultural Department for the purpose, and experiments will be taken up.

60. *Other Personal Investigations by the several Members of the Staff.* — The following statement gives an abstract of the progress in the problems undertaken in the past and those taken up newly in the year under report:—

Subject.	Name of investigator.	Year of commencement of the investigation.	Abstract of progress done.
1. Determination of the best stage of seedlings for transplanting and whether by any cultural means the lodging of a manured crop can be prevented.	Mr. V. L. Bhosekar, B.Ag., Superintendent, Ratnagiri Farm.	1918	Work was continued. Nothing of practical value came out during the year.
2. Eradication of weeds on *varkas* lands.	Mr. K. B. Gujar, Agricultural Investigator, Alibag Farm.	1918	A survey and analysis of weeds noticed was made. 80 have been collected and identified. The local crops and the methods of cultivation adopted by the people keep the weeds under control to a great extent. With the introduction of new crops which require to be sown, drilling, so as to admit of intercultivation, is necessary and has been found practicable.
3. Investigations into the possibilities of growing *san* crop for fibre in Konkan without *rabing*.	Do.	1918	Phosphatic manures seem to bring about results approximating to the effect of burning.
4. Designing of an ovendrier for drying plantains, betelnuts, cardamoms, &c.	Mr. M. R. Gokarn, Agricultural Overseer, Kanara.	1918	The construction of an experimental ovendrier has been completed to be available to be tested with the next crop of betelnut.
5. Designing of an implement for puddling rice fields more economically.	Do.	1918	This has been found decidedly advantageous. It will be widely demonstrated. The detailed account is being worked up for a publication.
6. How to utilise most profitably the large output of plantains fetching almost nothing at present in the betelnut gardens.	Do.	1919	Some work in finding out the suitability of the various local varieties for drying, variations in temperature required and the possibilities for making flour from unripe plantains was done.

Extension Work.

61. This consists in bringing agricultural improvements to the notice and into the practice of agriculturists and giving such advice and help as will make the agricultural industry in general more profitable. This work is principally carried on through the itinerant district staff who are called Agricultural Overseers. The agricultural stations also serve as standing centres of demonstration or as centres for distributing improved seed, manures and implements.

An incumbent to fill up the vacancy of the post of the Overseer for the Thana District was available only from November of the period under report. Kolaba District has been without any one for almost the whole of the year.

The institution of the posts of *kamgars* has greatly facilitated the increase in the quality and quantity of the work carried out. Three such posts have been allotted to the Konkan Division.

Popularization and Introduction of Agricultural Improvements.

62. The particular items in which work was carried on and the progress made in them during the year are reviewed below district by district.

Kanara District.

63. There was one Graduate Overseer assisted by one *kamgar*. This district has presented the greatest scope for propaganda work and owing to the unbroken continuity in the personnel and policy stands far ahead of the other Konkan Districts in the results achieved. 17 centres, spread over different parts of the district, each extending to a radius of about five miles, were made.

The Agricultural Overseer had thus some work or the other in 72 villages, in which he approached 320 cultivators, 75 of whom were new and willing to take up one improvement or another. The following is a synopsis of the work done during the year.

Bone Manure and Fish Manure for Rice.—There were two demonstration plots and at both the places the results impressed well with the consequence that three tons of bone-meal has been sold off for the following season.

Maskati Variety of Rice for the Uplands.—Three demonstration plots. In all of them it has satisfied the people as superior to the local variety. Demand for seed has arisen in the neighbourhood of the demonstration plots.

Groundnut.—Two demonstration plots on a large scale in Honavar Taluka having escaped the notice of wild animals fetched a good return and the owners wish to continue.

Red Mauritius Variety of Sugarcane.—Over a lakh and a half of seed sets were supplied to 80 cultivators through departmental arrangements, in addition to a large supply that must have taken place between the cultivators themselves. It is thus estimated that the area under this variety must have extended by about 75 to 100 acres during the year. Now the department has been working for over five years in this direction, a survey of the actual area which the Red Mauritius has replaced that of the local variety, made during the year, shows the figure of about 400 acres or over one-fifth of the total area under sugarcane of the whole district, the greatest progress being shown by the Sirsi and Honavar Talukas representing 30 and 40 per cent., respectively. The introduction of this improvement alone has increased the profits of the cultivators by Rs. 20,000 annually.

Poona Furnace and Pans.—These were demonstrated in eight places. As the rates of Poona pans are still high, and as there are already old copper pans, people could not be induced to go in for new pans. Only such persons as may be in need of buying new ones are likely to go in for iron pans, and only one iron pan was requisitioned during the year. But the pans which were kept on hire by the Agricultural Department were greatly appreciated and availed of. In all 11 pans were kept on hire at 8 centres and were used by about 100 cultivators fetching a hire of Rs. 40. The question whether Poona pans cannot be exchanged for copper pans has come to prominence, but there is not much hope of doing anything in the line until prices for the former cheapen down.

It has been found, however, that the improved furnace can be made to suit even the copper pans and still secure 40 to 45 per cent. both in time and fuel quantity of the advantages to be secured by using Poona pans and furnace both together. This is being brought to the notice of sugarcane growers.

Making of Solid Gul.—The local practice is of making a liquid or semi-solid product. Owing to the very great rise in prices for solid *gul*, large profits that could be made by manufacturing solid *gul* were demonstrated and the owners were very much pleased by the increased hard cash of about 75 per cent. that was actually realised by them.

Chatanooga No. 12 and other improved Sugarcane Mills.—These were demonstrated in 8 villages ; at two of these two departmental mills of Chatanooga type were kept on hire and fetched a hire of Rs. 40. A dozen mills of Chatanooga type were purchased, two of which were done by the Co-operative Implement Hire Society at Halga in Karwar Taluka. Cultivators are very ignorant of the adjustments of the iron mills and of the enormity of losses caused by defects in adjustment. The departmental staff inspected some 50 to 60 mills and set them right explaining to the cultivators how to do it for themselves.

Fish Manure for Sugarcane.—No concentrated manure of any sort is used for this crop in this district. A top-dressing of lbs. 1,250 of fish manure per acre was given at five demonstration plots, giving increases varying from 33 to 50 per cent. or net profits of Rs. 100 to 150 per acre which have fully convinced the owners of the plots and others who saw the crops. This resulted

into a demand of 40 *khandis* of fish manure through departmental arrangement in addition to the quantity which the cultivators could secure for themselves.

Onion.—During the year 400 lbs. of seed as against lbs. 265 of last year was distributed and the crop has now extended to about 20 villages in the coastal talukas. When it is remembered that each grower cultivates not more than 2 or 3 gunthas each and the first trials are restricted to even smaller areas, the above quantity represents that from 500 to 800 cultivators have taken to this crop. The wilt disease that is lately infesting the crop is a serious menace to the introduction and spread of this valuable crop. The use of fish manure was demonstrated at a few places to start with with satisfactory results.

Meston Plough.—This was domonstrated at six places in Honavar, four places in Kumta and two places in Siddapur Talukas, the plough being worked at each place for a sufficiently long period till the farmers and their servants were satisfied of the work and the notion that it would be too heavy for their cattle was removed. The *havik* cultivators are quicker appreciators than others. In all 16 new ploughs were sold.

Cotton Seed Cake as Cattle Feed.—Three tons were supplid during the year which has convinced the users of its cheapness and milk increasing qualities. Local merchants are being approached to stock this.

Ratnagiri District.

64. This district had one Graduate Overseer assisted by one *kamgar* for the propaganda work. The *kamgar* being new most of his time during the year was occupied in being trained. They visited in all 16 villages as follows :—Two in Ratnagiri, six in Sangmeshwar, three in Devgad, two in Malvan and three in Dapoli Talukas some of which had to be visited as often as ten times. In all 240 agriculturists were approached, 50 out of whom are new and likely to take to improved practices.

The district being very badly communicated, intensive propaganda was concentrated at only the five following centres :—(1) Ratnagiri, (2) Hatkhamba (Ratnagiri), (3) Devla (Sangmeshwar), (4) Sangmeshwar and (5) Kharepatan (Devgad).

As the Agricultural Overseer returned from famine work in the Ahmednagar District late in the monsoon, *kharif* items of popularization could not be taken up.

Bone Manure, Fish, Undi Cake and Ammonium Sulphate for Rice.—Bone manure demonstrated at Kelshi along the coast in the Dapoli Taluka has been very successful, so much so that a demand for three tons from that village alone was received for the following season.

Ratnagiri Farm arranged for four demonstration plots round about the farm for other manures recommended and as good results as on the farm were obtained at all the plots.

Extension of Sugarcane Cultivation.—There are many spots in this district possessing ample facilities for perennial irrigation for growing sugarcane which are not at all exploited. In a few localities where the crop is being grown, crudest methods of cultivation and manufacture are followed. With a view to bring the fullest possibilities of the crop to the notice of cultivators, demonstration plots are organised in connection with suitable persons. There were three of such during the year under report :—(1) Devla (Sangmeshwar), (2) Hatkhamba (Ratnagiri), and (3) Kharepatan (Devgad). These plots had to be constantly visited in order to get all the operations done quite properly and timely. At all the places the crop has produced great effects, and not only the owners of three plots have continued the cultivation on an extended scale but half a dozen others in the neighbourhood have also taken to the cultivation, providing that the Department gives them the same advice as to the pioneers.

Introduction of Striped Mauritius, Red Sport and Manjav Varieties.—All the seed obtainable on the Ratnagiri Farm was distributed to 10 cultivators.

Poona Furnace and Pans, Chatanooga Mill and Sabul Plough.—These were demonstrated at the three demonstration plots for crushing their entire area and the owners are sufficiently convinced of the advantages so as to go in for these improvements on their own account. The demonstration of these at Kharepatan during the last year has induced a landholder in the neighbourhood to buy one Chatanooga mill and a Poona pan for hiring out.

Onion.—This crop is not known except in Malvan and Vengurla Talukas of the District. Four demonstration plots, one in each of the centres except Hatkhamba, were provided. The crops in all places were successful and at some of the places the owners have expressed their intention to grow it on an extended scale in the following season.

Meston Plough.—This was demonstrated in three places, and a requisition for six ploughs is in hand.

Use of Cotton Seed Cake as Cattle Feed.—The first attempt in this direction made last year having been appreciated by the public, another consignment of 12 tons was stocked on the Ratnagiri Farm and was very soon disposed off. Local merchants are being persuaded to take this up.

Kolaba District.

No graduate was available to fill up the vacancy of the Agricultural Overseer of the district. Some extension work was however done by the Alibag Farm in the neighbourhood of the farm.

Fish and Karanj Cake Manures for Rice.—One demonstration plot on a tenant cultivator's field was arranged. The crops appeared to be better than the local crops but the difference did not, it seems, strike to the owner as sufficient to adopt these manures permanently.

Extension of the Cultivation of Sugarcane and Introduction of Improvements in that Crop.—Three new persons were induced to take to the cultivation of this profitable crop. 5,000 sets of striped and Red Mauritius were distributed. Two plots for the demonstration of sulphate of ammonia were arranged and the striking advantages have already attracted the attention of the owners and other interested on-lookers.

Thana District.

66. The vacant post of the overseer was filled from November. A Kamgar has been allotted to this district. The work in this district has been confined to the West Thana, which being favourably situated in many respects presents the largest scope for getting the most valuable results of the departmental activities in a comparatively short time.

Bringing the immensity of scope and facilities for profitably developing garden cultivation to the notice of the landowners and interesting them to take up to cultivation.—Twenty new land-owners were approached and a party was formed of them to visit Sakharam Patil's model farm near Palghar to actually demonstrate and convince them of what was preached. Many out of them have been favourably impressed and have begun to think seriously of the proposal. The lands of some such men were inspected and advice and definite schemes given.

Introduction of Improvements in the present methods of garden cultivation.—Use of more efficient ploughs such as sabul and the like and of harrows to bring about better and cheap preparatory tillage, ridge and row method of planting, saving of labour and water and increase in the yield and profits by the employment of interculturing implements and recommendation of new and more profitable crops in garden cultivation formed the principal activities of the year under this section. In all ten new garden cultivators were approached

during the year and all have adopted some one or another of our recommendations. 2 Surat blade harrows, 2 bullock hoes, 2 planett Junnior Bullock cultivators, Sabul ploughs, meston ploughs, 2 Bulsar *rahats* were arranged to be supplied.

Exhibitions, Demonstrations and Shows.

67. No exhibitions or shows were held during the year. Besides the large number of small local demonstrations that were given by the Agricultural Overseers in connection with the propaganda work in the districts, large demonstrations to show the several improvements in actual operation on the Government farms were organised by calling parties of cultivators from the districts. Both at the Alibag and Ratnagiri Farms these were organised on two occasions, once to show the improvements applicable to the *kharif* conditions, and a second time for the fair season items, the fair season one on the Ratnagiri Farm being principally for the members of the Ratnagiri District Co-operative Conference which was held at Ratnagiri this year. Though at each place arrangements were made to entertain 100 cultivators, the response and appreciation were much greater and more intelligent in the Ratnagiri District than in the Kolaba.

Supply of Implements, Manures, Seeds and other Articles to Order.

68. In order to meet the orders which are created as a result of propaganda work, all the three agricultural stations were made the principal agencies for obtaining and distributing the necessary articles until Co-operative Societies and private agencies think it worth while to take it up. The following statement represents the business of the year :—

Kind of article.	Alibag Farm.	Ratnagiri Farm.	Kumta Farm.	Arranged to be supplied direct from dealers without the intervention of the Farms.	Total.
Rice (lbs.) ...	7,561	80			7,641
Foreign vegetable seed ...		Worth Rs. 100			Worth. Rs. 100
Onion seed (lbs.) ...			370		370
Sugarcane sets ...	5,000	25,000	5,000		35,000
Groundnut (lbs.) ...	130	286			416
Shalu jawar (lbs.) ...	66				66
Castor seed (lbs.) ...	223				223
Shevri (lbs.) ...		12			12
Fish manure (mds.) ...	30	156	112	1,960	2,258
Bone meal (do.) ...	24	8	2		34
Oil cake for manure (mds.) ...	8				8
Sulphate of ammonia (lbs.) ...	531	60			591
Cotton seed cake as cattle feed (mds.).		336	84		420
Meston ploughs ...	7		16		23
Iron Leveller ...	1				1
Harrows ...	2				2
Chatanooga sugarcane mills ...			5	7	12
Poona pans ...			1		1

Denaturalised Salt for Manure.—The Bombay Government having sanctioned the resumption of the issue of denaturalised salt for manurial purposes, duty-free, the number of permits issued together with the total quantities for each district during the year under report is given in the following statement :—

	Thana.	Kolaba.	Ratnagiri.	Kanara.	Total.
Number of permits ...	13	4	47	87	153
Quantity in Bengal maunds ...	469	126	1,124	541	2,260

Visitors and Agricultural Advice by Correspondence.

69. In addition to a large number of enquiries received and dealt with on the spot by the propaganda staff in course of their tours, the following statement shows the number of visitors (besides the special parties arranged) and enquiries by correspondence for agricultural advice received and dealt with during the year under report by the various agricultural institutions and officers :—

Name of institution or officer.	No. of visitors.	No. of enquiries dealt with by correspondence.
Deputy Director of Agriculture ...	50	65
Rice Specialist ...	10	10
Entomological Assistant ...	15	10
Agricultural Overseer, Thana ...	39	21
Do. do. Ratnagiri ...	40	30
Do. do. Kanara ...	130	25
Alibag Farm ...	118	398
Ratnagiri Farm ...	94	25
Kumpta Farm ...	69	2
Jambul Agricultural School ...	26	51
Lord Willingdon Agricultural School ...	3	6
Total ...	544	578

Publications.

70. Leaflets on the following subjects were drawn up :—

(1) Cultivation of *jowar* on *varkas* lands as a *kharif* crop in the Konkan.

(2) Common Salt for Manure.

(3) Cultivation of *shalu jowar* on the *rabi* lands of the North Konkan.

Notes and articles were contributed to the various agricultural magazines by the members of the staff.

71. *The Konkan Agricultural Magazine.*—The monthly magazine in Marathi devoted exclusively to Konkan agriculture under the name "Konkan Sheti Samachar" conducted by Mr. Y. G. Gurjar of Alibag under the advice of

the Konkan Agricultural Department was continued to be published. Partly owing to the difficulty of getting compositors and partly owing to want of sufficient effort on the part of the proprietor, it has been very irregular in publication, six issues being in arrears. If this state of things continues the Government support will have to be withdrawn and some other arrangements made to have another agricultural magazine published for Konkan.

Agricultural Associations.

72. Eleven Agricultural Associations still continue to be on the list, though most of them are defunct, and with the exception of Ratnagiri District, Sirsi (Kanara District), Umbergaon (Thana District), and Mahim (Thana District), have not even responded to the call for their report of activities.

The Ratnagiri District Association reports some work of introducing certain improvements by its Ratnagiri Taluka Branch, and of securing the approval of the District Magistrate to their resolution for the grant of gun licenses to communal *shikaris* to be recommended by the Association for crop protection. Efforts are being made to see if this association can be stimulated into more and more activities by giving it a personal and constant guidance of the Deputy Director of Agriculture.

Sirsi Association continued the extension of Red Mauritius variety of sugarcane, and the hiring out of improved sugarcane mill and pans. It has persuaded the authorities of the *mari* temple fair for dedicating a breeding buffalo-bull of a renowned milk breed – *Surti*.

Mahim and Umbergaon reported that their Associations did not do any work.

AGRICULTURAL EDUCATION.

73. Both the vernacular (Marathi) Agricultural Schools—

(1) Jambul, Taluka Kalyan, District Thana.

(2) Lord Willingdon Agricultural School at Alibag, District Kolaba continued to be run during the year.

74. *Studentship and Progress.*—The standard for admission in respect of age or educational qualifications has remained the same as in the previous year. The total number of boys in the two schools at the end of the last school year was as follows:—

Name of School.	1st year.	2nd year.	Total.	Remarks.
Jambul School ...	10	15	25	In all 16 applications were received, all of whom being eligible were admitted. But only ten actually joined the school. With the two failed students who were allowed to continue, the first year class commenced with twelve. One of these was transferred to Loni School at his request and one was reported to have died at his home when on vacation. In the second year, out of the 16 that were promoted, one did not turn up in the second term.
Lord Willingdon Agricultural School, Alibag.	11	11	22	In all 16 applications were received out of which 13 were eligible and admitted but only eleven actually turned up.

These were derived from the following Districts:—

	Thana.	Bombay.	Kolaba (including Janjira State).	Ratnagiri.	Outside Konkan.	Total.
Jambul ...	14	7	14	4	4	25
Alibag ...	1	1			2	22

Arranged according to caste they stand as follows:—

Caste.	Jambul.	Alibag.
Marathas ...	8	5
Brahmins ...	10	15
Goud Saraswats ...	5	
Prabhus ...		2
Kshatriya ...	2	
Total ...	25	22

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The number of boys from the Maratha and other classes who form the bulk of the cultivating population is not proportionately large enough, the reason for which is that very few boys from these classes are found to reach up the fourth standard of their vernacular education and owing to the general lack of education amongst the parents of their classes they have no appreciation that education in agriculture can benefit them in any way.

The curriculum remained the same as in the past year. At Jambul the pumping plant not being yet put up on the river side even during the school year under report, practical work and demonstrations in something more interesting, instructive and attractive could not be arranged for. It is not possible to provide this adjunct at the Alibag School as there is not sufficient stock of water for an engine and pump in the irrigation well.

When the boys join in the Agricultural Schools in the first year, for the first few months they find it somewhat difficult to follow the instructions which require the application of their reasoning power rather than that of mere remembering of certain facts by rote to which they seem to have been accustomed in their past training. They however very soon enter into the spirit of the new method of instruction and take to practical work with readiness and zeal.

The boys were examined at the end of the school year in April 1920 with the following results:—

		No. of students that appeared for the examination.	No. of students that passed in all the subjects.	Remarks showing the degree of proficiency in general.
Jambul ...	Second year.	15	13	Only fair in agriculture both in principle and practice. Better in nature study, good in arithmetic, reading and writing, workshop and other subjects of secondary importance.
	First year ...	10	8	Poor in agriculture principles, and better in practice, fair in nature study. Good in arithmetic, reading and writing, very good in workshop.
Alibag ...	Second year.	11	8	Poor in agricultural theory and practice and almost in all other subjects except perhaps nature study.
	First year ...	11	8	Well up in agricultural theory but not as much in practical. Rather poor in nature study. Well up in other subjects.

The examiners—Messrs. G. K. Ranade, Assistant Professor of Agriculture, Agricultural College, Poona and V. G. Deshpande, Entomological Assistant, Konkan, have made the following observations:—

(*V. G. Deshpande.*)

I acted as co-examiner and examined the boys of both the schools, Jambul and the Lord Willingdon Agricultural School at Alibag, in nature study, arithmetic and agricultural geography and physiography. I wish to make a few general remarks by way of suggestions:—

(1) The course of arithmetic for the first year as laid down in the curriculum is very little as compared to that for the second year. The full course may be equally divided.

(2) There should always be a utiliterian point of view before the teachers while teaching any subjects and the practical economy of every operation or method should be laid great stress upon.

(3) There should be maintained practical note books for each class for the nature study lessons they have been taught. So that becomes a guide for the examiners to know what they have done and been taught.

(4) The written answers given by the boys were very laconic, may be through lack of knack of writing or want of information. But to my mind it seems that there are no text books. The text books are reservoirs of information ready to be tapped at any time. The notes as the boys take down when the teachers deliver must be necessarily not so exhaustive and the boys have too much to rely on their memories and grasping power. So until text books are ready, copius notes approved by a committee of teachers and the Deputy Director may be printed and be distributed to the boys. It will save a lot of energy and time both for the teachers and the taught.

(5) There should be some sort of remuneration for those who are appointed Examiners. Because surely they have to work hard in those days and especially the orals or practicals are very taxing.

(*G. K. Ranade.*)

I examined the students of the Jambul and Veshvi Agricultural Schools in the subjects of (1) Agriculture (theory and practice), (2) Rural life, (3) Reading and writing, (4) Smithy and carpentry and I am enclosing herewith my remarks on the impressions I had after examining the boys.

Jambul School.—Both in the first and the second years the students were good in practical agriculture, reading, writing, rural life, and fair in agricultural theory and workshop practice in which last the students were not properly trained.

Alibag School.—On the whole poorer than at Jambul. Fairly good in the theory of agriculture, but in practical did not seem to have well understood the manipulation of implements. Reading was fair but as the books prescribed were rather difficult and the lessons were not well taught the students could not properly explain what they read. Fairly good in writing though the substance in the case of the first year was poor. Not well informed in the subject of rural life and not properly trained in carpentry and smithy.

75. *Cost of Education.*—The total expenditure at the schools classified under the several important sub-heads was as follows :—

	Jambul School.	Lord Willingdon Agricultural School, Alibag, yet in making.
	Rs.	Rs.
Recurring.		
Teaching Establishment (including the mechanic).	2,678	1,933
Travelling Allowance to Establishment.	343	155
Stationery and materials for teaching in the workshop and tour of students.	658	546
School Farm including upkeep of live stock.	1,550	1,029
Boarding charges (including medical attendance).	3,335	4,209
Office expenses (including postage and telegrams).	149	250
Total ...	8,713	8,122
Non-recurring.		
Permanent buildings and structures ...	500 (silo)	
Purchase of teaching apparatus and equipment.	100	150
Purchase of dead stock (including school furniture, boarding utensils, Farm implements and workshop equipment).	237	1,412
Purchase of live-stock ...	219	227
Temporary structures ...	50	
Permanent improvements such as drainage and levelling construction of well, Farm roads, &c.	301	1,123
Total ...	1,407	2,912
Grand Total ...	10,120	11,034
Value of the school Farm produce used for the school boarding.	9 5 6	8 5 0

Out of these, Rs. 500 out of the expenses for the boarding charges of each school and Rs. 500 for silo at Jambul were granted from the Sir Sassoon David Trust Fund, the remaining being met from the public funds.

76. *General Developments.*—The plans and estimates of a complete set of the school buildings at the Lord Willingdon Agricultural School at Alibag are still under preparation by the Executive Engineer, Kolaba. In the meanwhile the students and the staff are being accommodated in the private bungalows, close by, of Sardar P. K. Biwalkar and Rao Bahadur G. M. Kamat of Alibag who have been very kind to keep them at our disposal for the purpose.

The workshop work, and housing of the school cattle were provided in some temporary arrangements.

At Jambul the setting up of the pumping plant has been taken up in hand by the Agricultural Engineer and it is hoped that the long felt need of providing irrigation and of demonstrating to the students and the agriculturists of the neighbourhood, how the spots of pools in the rivers could be profitably utilized, would be fulfilled by the next fair season. Two bores that were made near the residential premises have successfully tapped good and sufficient water for drinking, and the great difficulty that has been experienced in the past in providing fit drinking water has been removed.

77. *Public Opinion about this Form of Vernacular Agricultural Education.*—In the North Konkan the agricultural schools have not been appreciated as much as was expected. In spite of advertising through the local news-papers, through the Revenue and Educational Departments and the school staff going round in the vacations and fully explaining the arrangements and advantages of the schools at as many places as they can in the time they can afford to devote, the number of applicants has not been sufficient to fill up even half of the number provided for. The most important of the causes that have come to the notice are that—

(1) The uneducated class of cultivator thinks that there cannot be much to learn in agriculture.

(2) Others would not send their boys as there are no sure prospects of service in view for them after finishing the school course.

(3) The profession of farming which involves manual work is not held in high esteem for an educated person.

(4) The number of the real cultivators' sons who reach the passing of the fourth vernacular standard are few.

(5) Many such parents especially the mothers do not like to send their children away.

Thus one district appears to be too small a sphere in the case of Kolaba or Thana at any rate to get sufficient boys for a central agricultural school for a district. It is to be seen if conditions would improve as years pass on and more and more boys pass out of the school. A continuous and vigorous propaganda extending over a longer period in the year by a special staff touring round in the district will be attempted.

Some Experiences from Famine Relief Operations.

78. Though no direct work in connection with the famine relief operations was necessary during the year, still the operations of the past year presented an opportunity for watching the results of our recommendations. Some definite experiences which have been gained are being recorded here so that they may be useful if such a calamity were to ever arise again in Konkan.

(1) Usually after even the worst types of seasons as the one of 1918, the shortage of staple varieties of crops is not very serious so as to cause any anxiety, as there is generally a sufficient stock in any locality as a whole. Thus nowhere in Konkan any appreciable portion of land remained fallow for want of seed. The reports in this respect are usually over alarming and unduly pessimistic. Thus in the Ratnagiri District hardly any of the Rs. 2,000 worth of *nagli* seed that was requisitioned by the Collector was taken up for seed purposes.

(2) For more specialized and limited kinds, such as early varieties of rice, or *val* it is easier to survey the correct situation rapidly and any efforts that could be made are amply justified.

(3) For some reason or another, any propaganda work organised by the Agricultural Department in this direction meets with greater confidence, sympathy and co-operation of the agriculturists.

(4) Fumigation of *val* by carbon bisulphide has proved immensely effective in keeping the seed weevilfree for six months or more.

(5) If ever it would be again necessary to transfer paddy seed from one tract to another we have learnt that—

(*a*) *Bhadas* and *Panvel* varieties from North Konkan can well fill the place of the early varieties of *Sal* and others grown in Maval of the Poona District, while *Dodka* which is slightly late has been found unsuitable.

(*b*) *Nagli* from Karjat or Mokhada of North Konkan is too late a variety to be suitable for the Ratnagiri District except perhaps in the easternmost sub-montanic strip.

Personel.

79. The charge of the division was held by the undersigned throughout the year. Messrs. Parbhune and Khandekar, Head Masters of the Jambul and Alibag Schools being transferred to Central Division, Mr. Purandhare from the Ratnagiri Farm and Mr. Nimbalkar a new recruit took their places respectively. Mr. D. N. Desai was transferred to this Division from Gujarat and has been given the charge of the Thana Agricultural Overseer. The Division is still short by four graduates to fill up all the sanctioned posts.

All the staff have exerted their best to put in a hard and sincere work to the best of their respective abilities. This year I may add the name of Mr. M. R. Gokarn, Agricultural Overseer, Kanara, to the lists of persons selected out for special mention.

There has been a widespread discontent amongst the members of both the Upper and Lower Subordinate Service owing to the insufficiency of the scale of pay and prospects they are receiving. It has been almost impossible to secure suitable new recruits at the existing scales to fill up new posts or vacancies.

V. G. GOKHALE,

Deputy Director of Agriculture,
Konkan Division, Ratnagiri.

APPENDIX G.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, SIND, FOR THE YEAR 1919-20.

ADMINISTRATION.

1. The management of the Department of Agriculture in Sind is carried on by a Deputy Director of Agriculture who is under the administrative control of the Director of Agriculture, Bombay Presidency, Poona. He has a staff of one Divisional Superintendent of Agriculture an officer of the Provincial service and the following subordinate assistants:—

Graduates.			Non-Graduates.		
Number.	Grade.	Scale of Salary.	Number.	Grade.	Scale of Salary.
4	III	110-8-150	2	I	50-2-60
4	IV	75-5-100	4	II	35-2-45
4	,,	60-75-5-100	7	III	20-2-
			1	Special	75-5-100

The permanent Deputy Director of Agriculture Mr. T. F. Main remained absent on leave throughout the year and I acted in the vacant post. The vacancy caused in the post of the Divisional Superintendent by my deputation was held by Mr. Jaffurali Ansari from May to October 1919 when he reverted and was succeeded by Mr. Abdur Rehman who has continued since then.

1. Mirpurkhas Farm.
2. Seed Farm, Mirpurkhas.
3. Sukkur Farm.
4. Larkana Farm.
5. Landhi Farm.
6. Wheat Farm, Jacobabad.

The number of Government Farms worked during the year was as noted in the margin. In addition to these there were six sub-stations as are referred to in para. 53 below.

The Agricultural School, Mirpurkhas, continued to be worked on the previous lines and is fully reported upon in para. 57 below.

The budget of the Department in Sind for the year 1918-19 amounted to Rs. 1,68,475-13-5 as under:—

Salaries of officers and staff	...Rs.	44,123-10-8
Contingencies	... ,,	1,24,352- 2-9
Total	...Rs.	1,68,475-13-5

Season.

2. The chief factor in the season is the inundation of the River Indus which during the year under report was very good. By June the river had attained a good level which remained steady throughout the seasons. Thus the start of the Kharif season was normal and good and the inundation canals continued to flow throughout the greater part of September, unlike previous years, enabling large areas to be flooded for Bosi wheat (dry wheat farming) in Northern Sind. The cold weather supply seemed, however, to be below normal, as the Jamrao canal, the only perennial canal in the province, failed to give its normal supply. The irrigated wheats on it were accordingly adversely affected.

Rainfall.—This fell in varying amounts. Sukkur recorded about 3 inches while Jacobabad received only one inch. Mirpurkhas had 8'16" and Landhi 9'25". This fall though not heavy proved nevertheless injurious to cotton crop. It caused the shedding of bolls and flowers and produced conditions

very favourable to boll-worm and red leaf blight, the former attacked both Sindhi and American and the latter American cottons only.

Dust and Hail Storms.—A few dust storms were experienced in lower Sind in May-June which rather proved prejudicial to young cotton seedling. A couple of hail storms also occurred in May of the current year but these were more or less local and not widespread and did not prove injurious to Agriculture in any way as all the Rabi crops were then down and the sowings of Kharif crops had not begun.

Temperature.—Temperature did not run so high during the hot weather, the maximum being somewhat lower than the normal. Similarly the cold weather was relatively mild except for a few days in the beginning of February when very severe frost accompanied by some rain was experienced. The temperature went 2 degrees below the freezing point and the standing crops and fruit trees were hit very hard.

Labour Supply.—The labour supply was rather deficient and the wages were about 50% higer than the normal.

Pests and Diseases.—The jawar disease locally called "khas" (sterility of heads) which caused so very great damage to jawar last year was fortunately not much in evidence during the year under report. Cotton crop experienced boll-worm attack and the damage from this account was estimated at 3 annas in a rupee. Reports of the outbreak of rat pest in paddy and wheat were received from certain places in Lower Sind but the damage was not severe.

Prices.—These though far from being normal showed some tendency to fall during the year under report. Wheat at the harvest time was selling at Rs. 5-8-0 and cotton fetched Rs. 12-0-0 per Bengal maund towards the end of the season. Since then there had been a further fall and the April quotation per maund of Kapas (putties) was as low as Rs. 9-0-0.

Cottons.

3. *American Cotton.*—The varieties of this cotton under trial were as under:—

(*a*) Triumph from seed imported in 1913.
(*b*) Triumph from seed imported in 1917.
(*c*) Punjab F-4.

The first was sown on the Jamesabad sub-station and the second on the Mirpurkhas Experimental Farm and Khathar sub-station. Punjab F-4 was sown on the Seed Farm.

4. In para. 4 of last year's report, position with regard to Triumph from old seed was briefly explained and it was stated that there was no noticeable change in the size of bolls as was observed in the previous year (1917-18). The same observation continues during year under report on the crop grown to a distance of some miles from other American cottons with a view to avoiding all chances of cross fertilization taking place between the same species. The observations showed that the plants were mostly true to type with regard to vegetative characters except the size of bolls which were both large and small—the latter not falling off in size than in the previous year. It is difficult to advance any opinion whether this condition is due to acclimatization or to the impure state of the crop and hence it is proposed to resort to single plant cultures with the twofold object of solving this problem and at the same time evolving suitable strain from a variety having a very high reputation.

5. The results of the year's trial on the Jamesabad plot of the old Triumph cotton showed that two acres produced 574 lbs. or at the rate of 287 lbs. per acre and the ginning percentage was 28.

6. Owing to climatic conditions being favourable to red leaf blight old Triumph suffered from this disease to a far greater extent than Punjab F-4 but to an equal extent to Triumph raised from the newly imported seed. This together with some amount of flooding caused by the occurrence of an excessive rainfall in too short a time seemed to account for the low yield.

7. Regarding work on new Triumph mentioned in para. 6 of last year's report the following further observations have been recorded:—

(*a*) That the plants selected for fuzzy character of the seed produced offspring true to type.

(*b*) That the seeds originally selected for green colour of the fuzz have in their second generation produced offsprings mostly with the white fuzz. Hence this character is not a fixed character and both the kinds are identical and belong to the same variety.

New Triumph sown on the Mirpurkhas Farm failed on 2-acre plots due mainly to bad germination and to a severe attack of red leaf blight. The remaining one acre, *viz.*, plot A-2 had a good germination but afterwards it was greatly damaged by red leaf blight and yielded at the rate of only 145 lbs. per acre.

On the Khathar sub-station a plot yielded at the rate of lbs. 369 per acre. The attack of red leaf blight was as severe here as elsewhere.

8. With regard to Punjab F-4, 30 acres were sown on the Seed Farm. The average outturn was 560 lbs. per acre and the highest was 1,224 lbs. The wide range between the figures of average outturn and the highest yield is due to a variety of causes. In the first place the soil was not of uniform character. Some plots contained large patches of Kalar on which there was either very thin or no germination at all. Further about 4 inches of rainfall in 12 short hours caused flooding of the lowlying fields wherefrom water could not be drained off for full four days. This caused unhealthy water logging conditions. Moreover the rainfall of July which came in sharp showers caused shedding of flowers and bolls. The damage to cotton on this account is strikingly illustrated by the figure of yield of a plot that had been sown in June, *i.e.*, two months later than the other F-4 plots and consequently was not in flower at the time of rains. This plot gave an outturn of 1,224 lbs. per acre as against an average outturn of 560 lbs of the crop which was in flower at the time of rains. It should not however be understood from the foregoing account that the best time for sowing this cotton is in June. In fact the ideal time for sowing it is between March and April and the damage caused by too much rain falling in too short a time is rather of rare occurrence in Sind.

The whole of F-4 crop was attacked by leaf blight but the attack was much less severe on this cotton than on Triumph.

On the Landhi Farm half an acre plot sown with F-4 yielded at the rate of 640 lbs. per acre as compared with lbs. 816 of our selected N. R. and lbs. 720 of Cambodia It is remarkable that Cambodia a late ripening variety has yielded so well on the light soil of Landhi and yet it did not give a full crop having been killed off by the frost.

This is now the third year of the trial of Punjab F-4 cotton in Sind and the results point to the variety being much less succeptible to red leaf blight—a character most essential in American cottons in India and also yielding a fair crop even if sown late along with Sindhi.

9. F-4 cotton grown in the District occupied about 800 acres mostly on the Jamrao canal. Most of the crop was sown in April-May. The germination and after-growth was good but after the rains it was affected by the red leaf blight and boll worm. Owing to scarcity of labour the necessary weeding operations were not attended to properly by the growers. The average produce came to about three maunds per acre which compared favourably with the average produce of local cotton which, it must be noted, was equally affected by boll worm. The latter also suffered from water logging conditions owing to heavy rains to which F-4 appeared to stand better.

Arrangements were made with Messrs. Ralli Brothers to buy this cotton and they paid a premium from Rs. 2 to Rs. 3-8-0 depending upon the condition of the stuff with regard to purity and presence of leaf. Produce was either purchased direct by the sub-agents of the firm in the mofussil or delivered through the District Agricultural Overseers who represented the interests of the growers. Out of the whole lot some lbs. 36,000 of seed cotton specially selected for its purity were ginned separately under the supervision of the

Department and the seed which amounted to lbs. 24,000 kept for the current year's distribution. A few growers kept back their produce with the hope that the price would rise but it happened otherwise by the sudden fall of market. The public opinion with regard to this cotton seems to be—

(*a*) That it is an early ripener and thus permits of irrigation water being utilised for Rabi crops much earlier than in the case of the local cotton which has to be watered till late in season.

(*b*) It stands floods and water logging conditions better than the local cotton.

(*c*) That it suits both light and heavy soils.

The current year's demand for the seed which is almost double of that of the year under review shows that it has really found favour with the people.

The actual quantity of the seed distributed during the current year amounts to 70,640 lbs. which is short by about 6,000 lbs. indented for, early this year. This happened because of the proper sowing season having far advanced by the closure of the Jamrao canal in April and very defective and unsteady supply in the following months.

To meet the demand for seed, 40,000 lbs. were ordered out from the Punjab, 24,000 lbs. were purchased from Messrs. Ralli Brothers and 16,000 lbs. were obtained from the Seed Farm produce ginned in our own factory (purchased this year).

10. *Valuation of Cotton.*—Two samples of seed cotton (putties) one of Punjab F-4 and the other of Triumph grown from the newly imported seed on our farms were submitted to Messrs. Ralli Brothers' office at Karachi for opinion which was as under :—

"Triumph"—Strictly fully good owing to stain. Superior good staple.

"Punjab F-4"—Fine and superfine. Fair staple.

It will be seen from the above that the staple of Triumph is superior to that of Punjab F-4 but is less in grade to F-4 owing to stain which is perhaps due to the crop having been badly attacked by red leaf blight and boll worm.

11. *Sindhi Cotton.*—Sindhi local cotton as commonly grown in the Province consists of a mixture of 4 varieties botanically known as—

(*a*) Neglectum Rosea or White flowered-narrow-lobed.

(*b*) Neglectum Rosea Var Cutchica or White flowered-broad-lobed.

(*c*) Neglectum Vera or Yellow flowered-narrow-lobed.

(*d*) Neglectum Vera Var Malvancis or Yellow flowered-broad-lobed.

In Khandesh (Bombay Presidency) a similar mixture occurred in the Deshi cotton grown there and the isolation of these types by mass selection and subsequent comparative tests extending over several years showed that Rosea was the best of all the types both in point of prolificness and ginning percentage. The seed of this was accordingly multiplied and given out to cultivators. On the basis of this experience steps were taken in 1914-15 to harvest separately the white and yellow flowered types and the seed of these was sown in separate plots but the off-spring did not come true—very few white flowered plants being found in the plot sown with the seed of the selected white flowered plants and the leaves had the light green colour but the lobes were narrow. This mass selection of the seed having failed to give true plants due perhaps to the occurrence of natural cross fertilization taking place to a far greater extent in arid climate of Sind than in Khandesh or elsewhere, another method, namely, plant to plant selection was initiated. Several single plants in each variety were marked off and harvested separately and the seed sown next year. Cultures true to type were retained for further trial and those splitting up were rejected.

In the same year several flowers in each of the variety were covered with bags and harvested separately for sowing in the following year. With sustained work on the above lines since 1915 several pure strains with regard to morphological character have now been evolved which again have been

separated within themselves with a view to getting the best as regards outturn and ginning.

12. In para 11 of last year's summary report certain results of the comparative tests of the four types conducted on $\frac{1}{4}$th acre scale were given and it was stated that these tests would be repeated on field scale next year. This was done on an area of 30 acres and the results are summarized in Appendix A.

It will be seen from the figures of outturn that the experience of Khandesh has been repeated and Rosea has from economic consideration proved to be the best. About 1,500 lbs. of the best strains of Rosea are being grown this year both on Mirpurkhas Government Farms and on a Zamindar's land for the purpose of multiplying it for distribution next year.

A reference to remarks column will show that Vera type has a better staple than Rosea but it must be noted that there is a distinct trade in cottons having rough fibres but no staple and therefore this character is unimportant in neglectum cottons; for stapled cotton, trade can look to American types which are occupying no less attention of the Department.

13. Four acres sown with our isolated Rosea variety on the Jamesabad plot gave an average outturn of 702 lbs. per acre. This yield is reckoned to be 50% more than the average outturn of local mixture grown by cultivators in the neighbourhood of the sub-station and is very satisfactory in the season when boll worm prevailed and when Rosea also suffered in common with the cultivator's cotton crop.

On the Landhi Farm one of the selected Rosea strains gave an outturn of 816 lbs. per acre as against 720 lbs. of Cambodia and 640 lbs. of F-4.

14. Among other Indian cottons there was only one variety namely "Bani" under trial on a small scale. Last year's test of this cotton indicated that it is a late variety and consequently unsuitable for a country like Sind where any crop not over by the middle of December is liable to injury by a severe cold. The seed as originally received was not pure containing mixtures of several types which were removed from the standing crop and several single plants selected for raising pure line cultures. The irrigation conditions being unsatisfactory this year on the Jamrao, the test could not be carried to an end but pure cultures have been retained for sowing during the current year. The ginning and fibre tests of this cotton show that out of 37 strains selected from among the growing crop one strain gave as much as 35 per cent. of lint to seed, another gave 34·6 and the third gave 33·3, the usual ginning percentage being 25 only. Much reliance cannot however be placed on these figures as the quantity of samples put to tests was very small in each case.

Sugarcane.

15. Experiments with canes were discontinued on the Sukkur Farm because all the available area there, was required for growing fodder crops for the Dairy herd.

On the Landhi Farm comparative tests with striped Mauritius and Khadya—the two imported varieties were continued on half an acre plot each. The plots received farm yard manure at the rate of 30 cart loads per acre in two applications with a top dressing of Cocoanut cake at the rate of 320 lbs. per acre. The sets were planted on 6th December and about ten days afterwards a subordinate crop of onion from transplanted seedlings was grown on the top of ridges between sugarcane sets. "Khadya" grew vigorously and attained a hight of about ten feet. It was free from disease, striped Mauritius on the other hand was attacked by borer at the very initial stage of its growth and did not grow so well as Khadya.

16. In para. 28 of the last year's report it was noted that striped Mauritius was badly attacked by borer and a suggestion was made that sowing time which was then March would be changed to cold weather months, *e.g.*, November, after the practice of certain sugar tracts in the Province, to see if borer attack could be avoided or reduced. This was done during the year but the change of

the planting season did not prove advantageous as striped Mauritius was again attacked by borer. Khadya on the other hand did not develope this disease and grew as vigorously as in the previous year. This confirmed the last year's experience that striped Mauritius is more susceptible to borer attack than the hard caned Khadya variety. Under Sukkur conditions, however, striped Mauritius, tried some two years ago, showed remarkable resistance to red rot to which Laheni, a local variety, fell an easy prey.

17. Other point noted in connection with these varieties was the "gul" and juice yielding capacity of each. Following table gives the result of the experiment :—

Name of Variety.	Yield of Canes per acre in lbs.	Percentage of	
		Juice to Cane.	Gul to Juice.
Khadya ...	26,466	46	16
Striped Mauritius...	15,060	37	14

The above figures of yields which cannot be regarded as very satisfactory are to a large extent due to the very sandy nature of the farm soil.

The outturn of Khadya as also the sugar contents are greater than those of striped Mauritius but these results cannot be taken to be strictly comparable owing to striped Mauritius being diseased Khadya variety is not however liked for chewing, for this the striped Mauritius is preferred as also Java No. 33 of which there was a Ghunta or so on the farm. These varieties are much softer than Khadya and hence better suited for chewing purposes.

18. With regard to planting of canes the local method in practice is to plant them in beds about 10′ × 8′. In this method, operations such as earthing up, weeding, hoeing, &c., are inevitably required to be done by manual labour. In the improved method of planting introduced on the Farms "sets" are planted in long continuous rows 4 feet apart. The advantages of this system are :—

(*a*) That intertillage can be done by bullock power instead of by manual labour as also the earthing up by iron ploughs of the type of "Sabul."

(*b*) Economy of water is effected by directly irrigating the furrows in which cane grows instead of flooding the whole area.

(*c*) The furrows being far apart, more space is secured for free tillering of the cane and also for free æration.

Experiments with canes with improved method of planting have been started on the Sukkur Farm from the current year to demonstrate the efficacy of this method as against the local method of planting in small beds under well irrigation.

Rice.

19. Work on this crop was in progress on the Larkana Farm and to a small extent on the Sukkur Farm. At the latter place only one acre could be devoted to it. The object of experiment here was to get confirmation of the results obtained in previous years as to (1) the extent to which seed rate per acre could be successfully reduced and (2) how far could the normal rice season be advanced provided irrigation facilities exist.

The variety sown was "sathryoon" seed. It was sown on the 15th April in seed beds and transplanted on the 19th May, the seedlings becoming ready after a month and four days. The crop was harvested on the 15th September and gave an outturn of 1,588 lbs. per acre which is above the average outturn of the district. The yield would have been greater had not the crop suffered for want of irrigation water for full 25 days at the time of grain formation. This happened because the pumping plant irrigating the farm land could not be worked owing to an abnormal rise of the River Indus submerging the pump belt.

The results confirm the experience that paddy season can be successfully advanced by about a month and a half earlier than the normal.

133142

This investigation though not of much value under the existing agricultural conditions in which inundation determines the time for transplantation and the canals do not generally flow before June but is of considerable importance when changed irrigation conditions come about with the construction of the proposed barrage. Under those conditions water could be made available for rice much earlier in the season so that the fullest use of Rabi water could be made by growing Rabi crops in time after the harvest of paddy in mid-September.

20. Another confirmation of the result obtained was the successful reduction of seed rate to nearly one-fifth of that normally adopted in the District. This result has been made known by an issue of a leaflet. On the Larkana Farm, however, the results of experiment in this direction point to the seed rate reduction not being economically possible beyond one-half of that ordinarily used in this District and one of the reasons assigned by the Larkana Farm Superintendent for this, is that more the reduction in the seed rate the more the quantity of farm yard manure for "Rab" is required for seed bed and the supply of manure being very limited in a district devoted entirely to rice cultivation, the economy in seed does not counterbalance the cost of extra manure. This statement requires confirmation by experiment which has been started from the current year.

21. At Larkana the following experiments were in progress :—

(*a*) To test the effect of cold weather ploughing of paddy land after the crop is harvested as against the local practice of no cultivation between the successive cropping but only puddling the land just at the time of transplating rice seedlings.

(*b*) To determine the best date of transplanting under existing irrigation conditions

(*c*) To investigate a suitable interval between successive waterings.

(*d*) Seed selection and pure cultures.

(*e*) To find out the best distance at which rice seedlings should be transplanted.

(*f*) Varietal tests.

Results of experiment (*a*) are tabulated below and palpably show the advantages of fallow ploughing of paddy land:—

Puddled.				Cold weather ploughing.			
Plot No.	Area.	Yield in lbs.		Plot No.	Area.	Yield in lbs.	
		Grain.	Straw.			Grain.	Straw.
A-1 ...	0-20	1,064	2,709	A-1 ...	0-20	1,369	3,484
B-1 ...	0 20	847	1,129	B-1 ...	0-20	984	1,350

Note :—The soil quality of plot A-1 is superior to that of B-1.

This experiment will be discontinued from the current year as sufficient data has now been collected to form a subject matter of a leaflet which it is proposed to issue shortly.

Results of experiment (*b*) are summarised below :—

Date of Transplanting.	Outturn in lbs. per acre of	
	Grain.	Straw.
15th June ...	1,880	3,300
1st July ...	1,648	3,328
15th July ...	1,568	3,090
1st August ...	1,000	2,000

The results show that earlier the transplantation the better is the crop. The present irrigation conditions would admit of the transplanting being done by the 15th June when canals ordinarily begin to flow but the seedlings shall have to be raised in advance on wells as some intelligent cultivators already do. It must be noted however that the duplicate plot under the above experiment contained large patches of "Kalar" which resulted in the patchy growth of the crop and hence the results are not comparable. The experiment will be continued till results under uniform soil and other conditions are obtained.

Results of experiment (*c*) are not worth recording as the plots on which the experiment was conducted were about 4″ lower than the adjoining rice plots and it was suspected that they received seepage water from the higher plots. The plots have since been changed to allow of reliable figures being obtained.

Experiment (*d*).—In 1918-19 about 100 heads of Kangni, 100 heads of Sugdasi (Jajai) and 50 of Sathri were selected from crops growing under average conditions and stored separately for sowing in the year under report with the object of starting pure line culture. The work was unfortunately interrupted by a sudden breach in the main canal resulting in the submersion of the crop.

Results of spacing experiment point to seedlings planted 6″ apart giving better outturn than the crop sown closer, *viz.*, 4″ apart, as will be seen from the following table. The obvious explanation of the higher yields of plots A–5 (*b*) and B-5 (*b*) is that the plants had more room to grow and freely tiller:—

Plot	Interspace.	Yield in lbs. per	
		Grain.	Straw.
A-5 (*a*) ...	4	1,450	1,850
A-5 (*b*) ...	6″	1,724	2,250
B-5 (*a*) ...	4″	934	3,022
B-5 (*b*) ...	6″	1,097	3,600

Experiment (*f*).—Particluars of this experiment will be found in the annual report of that farm. The object of test is to study their respective characters, their growing periods, water requirements and prolificness. The year's results point to "Sathri" popularly known to take only 60 days to be ready for the sickle actually taking twice as much time.

"Torh" another variety showed resistance to "Kalar" to the greatest degree of all the local varieties.

"Sonahri" a scented variety gave the highest outturn of all the varieties under test. This variety is not however of commercial importance as it does not stand par-boiling (josh) so well as Kangni does and has therefore very little export trade.

22. *"Rab" Experiment.*—Experiment with several "rab" materials to test the relative merit of each started two years ago on the Larkana Farm gave out certain results during the year under review. The plan of the experiment was as under:—

(1) 12″ "Dabh" grass burnt.
(2) 4″ layer rice husk burnt.
(3) Cowdung burnt.
(4) Cowdung unburnt.
(5) Rice straw burnt.
(6) Oil cake one maund.

The growth of seedling was the quickest and most vigorous on cow dung burnt beds. Next to it in growth was oil cake bed but the uprooting of

seedlings in this was not so easy as in the rest owing to the soil sticking hard to the roots. Seedlings in "Dubh" grass bed grew sickly and stunted. In cow dung unburnt bed, there was an excessive growth of weeds, the growth of seedlings being comparatively slow. In rice husk and rice straw beds the growth was fair but the seedlings assumed somewhat sickly appearance. These remarks will show that cowdung burnt is the best "rab" material and that oil cake though next best has the disadvantage that soil sticks hard to the roots there being no ashy substance to make the surface soil soft for the easy uplifting of the seedling. An opinion is expressed by the Farm Superintendent that a 6" instead of 4" layer of rice husk is as good as cowdung Rab but this being not based on any actual test, the whole experiment is being repeated with an addition of Ammonia Sulphate at the rate of 5 lbs. per guntha, 6' layer of rice husk together with "Kirar" wood (capparis aphylla) ashes to test the relative merit of each material.

Wheats.

23. Work on this important crop is growing in volumes not only on our farms but in the district also where our Pusa 12 and Punjab 11 are the objects of admiration by the Public.

Comparative tests with Pusa 12 and Punjab 11 were made on an area of 40 acres on the Seed Farm, Mirpurkhas, as under :—

	A.	g.
Pusa 12	... 10	21½
Punjab 11	... 28	28½

The average yield of Pusa 12 came to 549 lbs. per acre and that of Punjab 11 to 610 lbs. The results are not strictly comparable owing to disparity of soil and difference in treatment in favour of Pusa 12 with regard to irrigation. Thus out of 25 plots under Punjab 11 only 11 plots received two waterings and the rest only one while out of 11 plots under Pusa 12, 10 received two waterings and only one plot one watering. In point of irrigational treatment therefore Pusa 12 received better treatment than Punjab 11 and yet the latter gave more outturn than the former. This low outturn of Pusa 12 may well be attributed to very severe frost in February when Pusa 12, early crop as it is, was in the advanced stage of grain formation unlike Punjab 11 and thus suffered more damage.

24. On the Larkana Farm comparative tests were designed to be carried out between the following varieties:—

Pusa 12
Punjab 11
Thori
Phundani } 2 local varieties.

Unfortunately Pusa 12, Thori and Phundani in most plots contained a lot of mixture—the mixture having taken place at the time of sowing through the negligence of the Farm Superintendent and hence the experiments were vitiated. Observations however showed that Pusa 12 suffered the most from the frost while damage on this account to Punjab 11 was negligible. The highest yield of Punjab 11 was 1,616 lbs. per acre and the average 1,315 lbs. per acre. The crop received two waterings.

The results indicate the high yielding capacity of Punjab 11 in an unfavourable wheat year and on soil which is by no means uniform or sweet.

25. On the Mirpurkhas Farm comparative tests with Pusa 12, Phundani and Thori were carried out on an area of 4 acres; each variety occupying alternate double lines. This method was resorted to because the soil condition of plots was different from each other and hence uniformity of soil was difficult

to secure for all the varieties equally. The results of the experiment are summarised below :—

Plot No.	Outturn per acre in lbs. of Pusa 12.	Phundani.	Thori.
D—2 ...	466	926	1,035
D—3 ...	984	876	1,332
D—4 ...	789	1,029	1,303
D—5 ...	758	1,105	947

The last two are local varieties and are awnless. The low outturn of Pusa 12 can be attributed to frost from which Phundani and Thori escaped being not in ears at the time of its occurrence. The crop received 2-3 waterings. It seems necessary to repeat this experiment in order to secure normal conditions for Pusa 12 before passing any final verdict on the merits of the two local wheats under review.

26. On the Wheat Farm, Jacobabad, total area put under wheat was 22 acres and 20 gunthas, out of which about 19 acres were under Pusa 12 and the rest under Punjab 11 and local Phundani; the whole area being bosi, *i.e.*, no irrigation water applied to the standing crop as none was available. The figures of yields are not yet available as the crop is in the process of being threshed, but the results are not comparable owing to an enormous damage to Pusa 12 caused by frost. The damage is estimated at 10 annas in the rupee. Both on the Sukkur Farm and on the Wheat Farm Pusa 12 threw out a number of new shoots after the injury from the frost but these could not keep pace with the parent plants and made the harvest of ripe and unripe grain separately difficult.

27. During the year under report 33,629 lbs. of Pusa 12 and 138,457 lbs. of Punjab 11 were distributed as under :—

District.	Pusa 12.	Punjab 11.
Thar and Parkar ...	4,485	86,632
Hyderabad ...	2,364	1,920
Nawabshah ...	5,700	29,060
Sukkur ...	8,320	40
Upper Sind Frontier ...	7,960	4,800
Larkana ...	3,760	16,005

In addition to these a large quantity of Pusa 12 seed reserved from the last harvest by cultivators in Upper Sind was sown.

Inspection of these wheats showed that, as usual, Pusa 12 came into ears from 2 to 3 weeks earlier than Punjab 11 but apart from having been badly hit by the frost of February was damaged by birds and pigs to a greater extent than Punjab 11, on katcha lands which, as a rule, are surrounded by forest. On "pucca" and other lands except those on the Jamrao canal the bird and pig attacks were absent but the damage from frost was similar in extent. In spite, however, of these facts, Pusa continues to enjoy the same amount of popularity which it has been held in since its introduction, particularly in Northern Sind where growers refuse to part with even a single grain of their entire produce of Pusa 12 and wish to utilise the whole quantity for seed next year. Punjab 11 though inferior in grain is most liked in tracts where birds and pigs are the pests.

The harvest of wheat having been delayed this year on account of frost the district figures are not completely to hand. Supplementary information in this regard will be submitted along with the farm reports of those tracts in which these varieties have been extensively grown.

28. On the Shikarpur demonstration plot Pusa 12 sown along with Punjab 11 gave an excellent outturn of 1,708 lbs. per acre as against 1,694 lbs. of Punjab 11. Pusa 12 escaped damage from frost here and the reason assigned is that the crop happened to have been irrigated only a few days before the occurrence of the frost and the land was moist then.

29. Pusa 12, Punjab 11 and Sharbati, a local variety sown on the Jamesabad sub-station, gave an outturn of 328 lbs., 820 lbs. and 328 lbs. each respectively, Pusa 12 suffering from frost here too.

30 Work with the isolation of different types found mixed in the local wheats of Sind and raising of pure line cultures is continued. Most of the cultures were true to type as regards morphological characters but their economic characters could not be studied owing to deficiency of irrigation water. A botanical classification of the principal types found till now, has however been drawn up.

Berseem.

31. The crop continued to be grown on several of the farms noted in the margin. On the Jamrao canal there was an unprecedented deficiency of water during the cold weather and consequently berseem crop on both the Seed Farm and the Experimental Farm, Mirpurkhas, did not come to much and was used for farm cattle.

Sukkur Farm.
Mirpurkhas Farm.
Seed Farm, Mirpurkhas.
Larkana Farm.
Landhi Farm.

On the Larkana Farm 8 acres were put under berseem and watered from the Ghar canal by means of a pump. On an average 3 to 4 cuttings were obtained, each ranging from 8,000 lbs. to 11,000 lbs.

On the Landhi Farm there were two acres and the yields in three cuttings from each of the plots were as under:—

Number of the plot.	Yield in lbs.	Remarks.
C—1 ...	20,360	These yields are rather poor and are entirely due to the very sandy nature of the farm soil.
C—2 ...	17,404	
B—2 ...	15,200	

On the Sukkur Farm where irrigational conditions for the successful cultivation of berseem are ideal, about 20 acres were sown and cut for green fodder as well as for hay. Detailed figures will be found in the Annual Report of that farm.

32. With regard to district crop 8,284 lbs. of seed were distributed as under:—

District.		Quantity.
Thar & Parkar	...	4,899
Hyderabad	...	1,082
Sukkur	...	929
Karachi	...	162
Larkana	...	399
Bhawalpur State	...	80
Khairpur State	...	240
Assam	...	40
Baluchistan	...	40
Gwaliar State	...	80
Junagadh State	...	20
Punjab Province	...	202
Central Provinces	...	40
Presidency Proper	...	51
Others	...	20

On the Jamrao the crop suffered owing to insufficiency of water and on an average two cuttings only were obtained. Elsewhere it was grown on lift water

and is reported to have done well. Part of the seed given to zemindars in Larkana District was home grown and from the points of germination and growth did as well as the imported seed. In Upper Sind berseem seems to be growing in popularity specially near towns but the crop has at present a limited scope for extension in that tract.

33. In para. 24 of the last year's report certain observations with regard to berseem seed production in Sind were made and an explanation was advanced that the higher yields of seed on the Larkana Farm, in that and the previous year, was the probable result of the removal of lesser quantity of green berseem, *viz.*, one cutting only from seed plots. Natural richness of the land was also believed to partially contribute to seed production The whole problem, however, required thorough investigation to enable definite conclusions to be arrived at and to this end an experiment having for its object the sifting of the following points has been laid out in the current year on such farms as have irrigational conditions favourable in the berseem season :—

(*a*) Number of cuttings to be taken before the crop is left to seed.

(*b*) Effect of the soil very rich or moderately rich- on the seed production.

(*c*) Manure *versus* non-manure.

(*d*) Early *versus* late sowing.

Fruit.

34. Work on fruit continued on the same lines as in the previous year with only one departure that an additional area of one acre eight gunthas has been added on the Mirpurkhas Farm to its culture. On this area best varieties of oranges, pomelos imported from various parts of India both local to those parts and also foreign have been planted with a view to adding to the previous stock of these such varieties as are of economic importance and suit Sind conditions well. In addition to these, plants of various varieties of citrons, limes and lemons have been imported with the object of finding out by actual tests the best stock or stocks of budding oranges and pomelos on.

Among the already existing fruit trees Nagpur Oranges did very well again and were an object of much admiration to the public. The crop was disposed of by contract sale and realised Rs. 600.

Grapes of which we have two varieties, *viz.*, Gulabi (Rose scented) and Motia (Jasmine scented) under cultivation for some years and which have now attained a very high reputation realized Rs. 835-7-0 ; a pound fetching as much as annas eight.

Peaches of which we have Indian, American, English and Quetta varieties only some fruited, the rest being yet too young. The fruit was in much demand by the public. The total sale proceeds amounted to Rs. 402-14-3 as against Rs. 255-0-6 realised last year.

Mangoes.—Both Bombay grafted and country of which we have a small plantation were not attacked by "Mahlo" disease in the current year but the severe frost which came off at the time when mangoes were in full blossom hit them very hard not only these but peaches, papayas, and apples also.

35.—*The New Orchard.*—The new orchard of which mention was made in para. 35 of last year's report is doing well. Pear trees bore a few fruits which were of excellent flavour. This is the first time the pear has fruited in Sind and the common impression that it will never fruit under Sind conditions does not therefore now hold good.

Quetta apple which is of the size of a large Bombay mango planted about four years ago also bore a few fruits practically of the same size and flavour as attained at its original home. This is a" Find" and steps are being taken to increase the plantation by budding this variety on country apples which is a small variety of the size of a small lemon.

Among other fruit trees planted in the New Orchard American and other grapes, peaches and a few orange plants also bore though a very small crop. A study is being made as to their bearing characters and the quality of fruits.

36. On the Landhi Farm trials of two important Bombay plantains, red and green, showed that the former apart from growing very stunted did not fruit even up to the third year of its planting and that the latter though growing luxuriantly fruited but little. A variety called Rajpuri received from Poona gave a small crop of fruit but it is not so superior as the red or green of Bombay. A few varieties of bananas of good fame have recently been ordered out from Ceylon, Madras and Calcutta for trial and selection.

37. The Farm had a very successful year with Papaya cultivation, local as well as imported. They bore heavily and a continuous supply of fruit is being kept up by transplanting seedlings at different intervals of time. Useful experience was gained as to the space at which the young seedlings should be transplanted. Young seedlings planted 3′ apart were found to be useful because on flowering about 50% of the young seedings had to be rejected for their turning out to be males so that after removing males a distance of 6′ was automatically secured which was found to be the right distance. Seeds of a number of varieties have been received from the different parts of India and are being tested.

Konkan cocoanuts and Persian Gulf dates are thriving and the former show signs of bearing fruit in the current year.

1. Lemon plants.
2. Nagpur orange plants.
3. Saharanpur orange plants.
4. Sylhet orange plants.
5. Batli mango plants.
6. Hapoos mango plants.
7. Pyari.
8. Cluster.
9. Deshi.
10. Peach plants.
11. Gulabi grape plants.
12. Black Saharanpur Plants.
13. Khaki Saharanpur.
14. Red Saharanpur.
15. White Sahranpur.
16. Papnus plants.
17. Grape cuttings.

38. The principal sales of fruitstock on the Mirpukrhas Farm during the year were as noted in the margin.

Rotations.

39. No new departure is to be noted in the order of rotation introduced on the Mirpurkhas, Landhi and Larkana Farms. The orders of cropping with regard to working out suitable rotations to meet the present and future conditions of irrigation on each with their results are given in the respective Farm reports.

Irrigation.

40. In paragraph 41 of the last year's report certain remarks were made with regard to growing of wheat with 1 to 2 irrigations judiciously given to the standing crop or giving no water at all provided the tillage methods described under cultural operations were closely followed.

The year's results of the experiment in which about 50 acres were sown with wheat on the Seed Farm in the Jamrao tract confirmed the previous year's experience. Out of the above area 24 acres received only one irrigation and the rest two as shown below:—

No of waterings.	Average outturn per acre in lbs.	Remarks.
1	417	Land rather stiff
2	648	

Both lots could not receive water at the right stage of their water requirements and hence the low yields. The higher yields of crops receiving two waterings may not be entirely attributed to the more number of waterings because the first set of plots contained unlike the other lot a number of Kalar

patches. The outturns may however be regarded as very satisfactory in the season when the bulk of irrigated wheat in the Jamrao tract suffered in common with our own wheat from the deficiency of water and were reported either to have entirely failed or yielded much below the average. The figures of outturn of our farms are therefore indicative of the extent to which the bad effects of the deficiency of water could be neutralized by adopting the superior tillage methods and should prove to be of considerable value for the Jamrao tract, where deficiency of water in Rabi has now come to be the common feature and where general belief is that it is not possible to grow successful crop of wheat with less than four to five waterings. It seems probable however that the system advocated will receive a great impetus if the Engineering Department could see their way in remitting partly or wholly water assessment on crops grown with reduced number of waterings or with no irrigation at all to the standing crop. This inducement is not only likely to give a fairly certain crop of wheat by the Zemindars taking to better tillage method but will also tend to check any falling off in the total wheat area due to deficiency of water in the *Rabi*.

Cultural Operations.

41. Operations in connection with cultural experiments were continued on the same lines as reported in para. 42 of the last year's report. The obstacle in the way of getting good seed bed prepared for using Gujarat cotton drill has been overcome by the introduction after repeated trials of a tube attached behind a local plough by which seed is dropped in furrows made by the plough. The distance between the rows is secured by the use of a yoke which should be 4′ long between the centres of bullock's necks for lines 2′ apart. For this method of drilling an elaborate preparatory tillage is not necessary. A couple of ploughings with the Egyptian plough followed by "samaring" has been found to answer the purpose of a good seed bed quite well. This is remarkable in a country where scarcity of labour is a limiting factor in the way of introduction of any elaborate cultural operations requiring excessive amount of labour.

Drilling gives satisfactory results on free working soils. On stiff soils the germination is generally patchy owing to the reason that such lands are generally cloddy after ploughing and the seed dropping below clodds, does not come out.

Further trials with intercultivation of crops sown in lines showed that a country or an Egyptian plough is the best implement for interculture but it is important to see that the operations are done at the proper stage when the land is neither too dry nor too wet.

42. On the Landhi Farm Planet Junior Hand hoe has given a great satisfaction and is likely to find favour with the cultivators. The success is due to the fact that the soil is sandy and hence it works freely which is not the case on stiff soils found in alluvial tracts of Sind.

With regard to cultural operations for wheat referred to in para. 40 above the practice is to till the land at intervals throughout the hot weather by wooden or iron ploughs followed by samaring after each ploughing and then to water it by October, open the land again and then drill the seed in moist soil. By this method not only weathering operations are greatly facilitated but the soil becomes receptive to tender wheat roots.

District Work.

43. The principal items of programme of district work during the year were:—

(1) Demonstration of improved method of cultivation on cultivators' fields.

(2) Popularization and distribution of improved implements.

(3) Distribution of superior seeds.

(4) Popularization of crops in tracts where they are not ordinarily grown.

(5) Holding of agricultural shows.

(6) Organization of demonstration plots in suitable centres.

(7) Aid to the Public.

The chief line of work in the demonstration of improved method of cultivation is the sowing of crops in lines instead of broadcasting the seed which is the common feature of Sind agriculture. This system demands better cultivation for providing good seed bed for using drill. Thus the advantages claimed in introducing this system is not only to secure line sowing method of crop but to indirectly attack the large problem of improved cultivation. It must be noted, however, that drilling method has been so simplified from economic consideration as not to need very high cultivation by substituting for Gujarat cotton drill a tube which is attached behind the plough and which drops seed in the furrow. This has been described fully in para. 41 above.

44. Drilling demonstrations were given in the villages noted below:—

No. of demonstrations.	Village.	Taluka.	District.
10	Kathri	Mirpurkhas	Thar & Parkar
4	84th Mile Jamrao	Jamesabad	,,
4	Jamesabad	,,	,,
2	Gundar	Hyderabad	Hyderabad
2	Hyderabad	,,	,,
10	Oderolal	Hala	,,
1	Daur	Nawabshah	Nawabshah
1	60th Mile Nasrat	,,	,,
1	Khakat	,,	,,
1	Shahadadpur	,,	,,
1	Shikarpur	Shikarpur	Sukkur

and each plot extended over an area of ½ acre to 4 acres.

The demonstrations were successful at most of the places. The plots were intercultivated by bullock power and the cultivators were well impressed with the superiority of the drill method over broadcasting seed which apart from needing two to three costly hand hoeings at the time when labour is most scarce does not admit of hard crust formed after the drying up of irrigation water on alluvial soil, being effectively broken—a condition highly prejudicial both to crop and to soil texture.

Demonstrations at 84th Mile and in some villages in Nawabshah District were not very successful owing to Kalar patches at the former place and to flooding and other causes at the latter. As a result of these demonstrations a zemindar in Kathri village of Mirpurkhas Taluka independently drilled about 16 acres and intercultured by his own men and bullocks with excellent results.

In the neighbourhood of Jamesabad sub-station it is now a common sight to see small cultivators sowing their crop by drill not only cotton but bajri and wheat also.

45. *Popularization and Distribution of improved Implements.*—As usual village to village demonstrations with improved agricultural implements were given by the District staff. Working demonstrations were also given at various shows and as a result of these 16 Monsoon, 4 Rajah and 65 Egyptian ploughs were sold. In addition 4 hand archimedian screws, 6 scrapers, 8 tube drills, 4 yokes were ordered out and supplied. Egyptian ploughs continued to be made by local "mistries" and have now completely replaced local ploughs in certain tracts of the Jamrao and are fast growing in popularity in other parts of Sind.

46. *Distribution of Superior Seeds.*—Among the various seeds distributed, cotton, wheat, berseem and potato seeds were the chief ones. The quantity of each seed distributed was as under:—

F-4 Cotton	... lbs.	54,100
Bhitshah Cotton	... „	1,600
N. R. Cotton	... „	1,600
Pusa 12 wheat	... „	33,629
Punjab 11	... „	138,457
Berseem seed	... „	8,284
Potatoes		
Farkhabad	... „	103,760
Kalka	... „	48,000

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The above figures will show that the distribution work has grown in volumes taxing the powers of the very limited staff to their utmost.

Potato seeds were purchased at a total cost of Rs. 21,008-12-3 through the U. P. Agricultural Department to meet the indents principally of Landhi-malir zemindars. The cost was met from the special grant of Rs. 30,000 sanctioned by Government for the purpose. The distribution was so well managed by Mr. Ghulam Mustafa, Superintendent, Landhi Farm, as to leave a profit of Rs. 290-7-0 excluding 1,000 baskets worth Rs. 93-12-0. There was no potato seed available in the country in August last for seed purposes and it was feared that the area under potato cultivation would greatly fall on this account in the season under report. The situation was, however, improved by the timely help of the Department and so well was the help appreciated that a deputation of about 50 representative zemindars waited on the Director of Agriculture, Poona, for permission to give a reward of a watch worth Rs. 50 to the Superintendent, Landhi Farm, for his trouble.

47. *Popularization of crops in tracts where they are not ordinarily grown.*—Efforts to popularize cotton cultivation both Sindhi and American in Upper Sind where they are practically unknown received an impetus during the year under report. 1,000 lbs. of F-4 seed were distributed among three zemindars one at Shikarpur and two in Upper Sind Frontier District. One man got an average yield of 400 lbs. per acre and was much pleased with the result. He got his produce hand ginned and kept the whole quantity of seed for the current year's sowing. The crops of the remaining two could not be inspected owing to transport difficulties but the correspondence which the Divisional Superintendent had with these men shows that the crop yielded very well, at the rate of about 700 lbs. per acre.

48. At the request of an intelligent zemindar of Garhi Yasin (Sukkur District) four varieties, two of superior grain quality and two early ripeners were ordered out from Bengal and given to him for sowing during the year under report. The names of the varieties were—

(*a*) Doud Khani.
(*b*) Badsa Bhog.
(*c*) Katrick Sinni.
(*d*) Rai Mukhi.

All the varieties though received in June were transplanted so late as the following August. For want of due care on the part of zemindar's men only one variety, namely, Doudkhani ripened satisfactorily, the others having completely failed. The peculiar feature about Doudkhani variety as reported by the Superintendent, Sukkur Farm, was that it ripened late as it was sown by the 1st August and that inspite of its not having received any irrigation between the harvest in December and the fall of river in September it attained a height of 8 to 9′ and yielded fairly well. None of the local varieties according to the popular opinion could have withstood these conditions to a degree to which this Bengal variety stood. The zemindar is anxious to try them again under better care.

49. Cultivation of gram in the Jamrao tract is unknown. Past three years trial of this on field scale on the Seed Farm gave very encouraging results. The tests of the year under report on 12½ acres gave an average outturn of 526 lbs. per acre, the highest being 1,004 lbs. per acre. These are very satisfactory results specially in a year when damage from frost to all the Rabi crops was of common occurrence. The crop was sown with the usual tillage method described in para. 40 above and did not receive a single irrigation. The results should appeal to the Public and the cultivation of this valuable crop on the Jamrao will be of immense advantage not only as a soil restorative but as a paying grain crop needing no irrigation, if properly sown.

50. Concerning introduction of "Bosi" system of wheat cultivation in Nawabshah District where it is unknown beyond lands along the River Indus and where cold weather supply of irrigation water is not available an attempt was made to prepare a piece of land on the Nawabshah sub-station for Bosi wheat in the hot weather by repeated ploughings. In September the land was flooded and Pusa 12 and Punjab 11 wheats drilled in November following. The crop did not come to much owing to very severe bird attack, there being no other Rabi cultivation for miles. Frost also did considerable damage. The trials will be repeated on a fairly large scale to allow of adequate arrangements being made to combat bird pest.

51. *Shows and Demonstrations.*—There were two agricultural shows and two elaborately organized demonstrations during the year as noted in the margin. Nawabshah show was purely an agricultural show and was held on the 22nd and 23rd January 1920. The show prospectus provided prizes to the aggregate value of Rs. 400 of which Rs. 332 were only awarded. The quality of exhibits was specially satisfactory in case of cottons, garden produce of the Mirpurkhas Farm and the vegetables grown by the students of the Agricultural School, Pusa 12 and Punjab 11 wheats, F-4 American Cotton and four strains separated from Dehsi cotton were the objects of great interest.

Nawabshah.
Larkana.
Ghotki.
Naushahro Feroz.

Larkana show was, as usual, combined with Cattle and Pony show. The samples of wheat, rice and jawars exhibited at the show were of better quality than those shown in the previous year. The total amount given in prizes was Rs. 480 as against Rs. 390 awarded last year. As usual all deparmental implements of practical utility were shown in working order and the samples of produce of various Farms exhibited. The shows were well attended and the visitors evinced a good deal of interest.

52. The demonstrations given at Ghotki in Sukkur District and at Naushahro in Nawabshah District were well attended and were a great success. Demonstrations at Naushahro lasting for two days was specially organised with the departmental contribution of Rs. 100 to demonstrate several of the improved implements and superior seeds in an important agricultural tract. The Collector of Nawabshah kindly took keen personal interest in the show.

53. *Organization of demonstration plots in suitable centres.*—The demonstration plots worked during the year were as noted in the margin. The last four were managed by the Farm Superintendents of Sukkur, Mirpurkhas and Larkana, respectively. Except Khathar, Nawabshah and Kambar the others were run on hari system, *i.e.*, the general work was performed by the tenant who took share of the produce while special expenditure was only met by the Department. Experience has shown that the sub-station run on hari system cost very little but the standard of agriculture obtained by such working is not up to the mark. It seems at the same time desirable that we should show our improved methods and superior crops under conditions similar to those obtained by zemindars and any thing achieved in this way will be of far greater utility than aiming at things which we could not possibly secure without divergence from the system in general practice. Thus the object should be to give what a cultivator is ready to receive and not what we want him to do without regard to his economic condition. Under the circumstances it would perhaps be advisable to revert to the old method of working

1. Jamesabad.
2. Daur.
3. Shikarpur.
4. Nawabshah.
5. Khathar.
6. Kambar.

the sub-station by hari system, keeping a full-time fieldman or a Kamgar at each sub-station to get as far as possible the special operations carried out.

The improved crops demonstrated at these sub-stations were Punjab F-4 American Cotton, Punjab 11 and Pusa 12 wheats, Rosea strain separated from Deshi cotton, garden crops at Khathar, rice seed economy and Dubari berseem cultivation at Kambar. Cultivation at these sub-stations was carried out with improved implements and the crops were sown in lines to admit of intercultivation being done by bullock power.

54. *Aid to Public.*—The lines on which the demonstrations are being carried out will appear from the previous paragraphs. During the course of the year several verbal and written enquiries were received and duly attended to. Zemindars who purchased improved implements from the Department were visited and the correct uses of the implements demonstrated. Demonstration with regard to improved method of cane cultivation were given in Mirpursakro, one of the important cane growing tracts. Further, the cane growers were taught as to how to make solid Gur in place of the liquid form which they were making and packing in old kerosine tins. Advices with regard to fruit culture, &c., were freely given and the crops grown from departmental seeds inspected from time to time and the necessary advice given.

Live Stock.

55. There is no change to report in this line of work. The breeding of famous Karachi milch cows continued during the year with the two-fold object of improving the breed and testing milk yields.

The strength of the herd belonging to the Willingdon Cattle Farm kept on the Mirpurkhas Farm and Seed Farm, Mirpurkhas, pending their transfer to that stock Farm was 18 consisting of six cows, four bulls, four heifers and four bull calves. Out of six cows, five were in milk during the year and one was dry having only just calved (21-3-20). The highest milk yield from two teats only was 1,964, lbs. the remaining two teats were allowed to young one; and the lowest was 869 from 1st April to 31st March. The peculiarity of cow "Sabhagi" which has given the highest milk yield is that she is in milk over 12 months.

Of the total strength of 15 consisting of three cows, one bull, four heifers and seven calves belonging to this Department, all the three cows were in milk, cow "Karachi" has given lbs. 2,617 during the year and has been in milk over a year.

With regard to the herd of 12 "Konkreji" cattle two cows out of ten died of anthrax, four have been covered about a month back.

The number of bulls of this breed is two, each being about three and a half years old.

The total production of milk during the year amounted to 8,492½ lbs. only.

A flock of goats and sheep of the total strength of about 100 including young ones is being maintained on the Landhi Farm with the special object of improving farm sandy soil with their droppings.

56. Concerning Dairy herd at Sukkur which has for its object the practising of "mixed farming" which is expected to have an important bearing on the agriculture of the country when the construction of Barrage is an accomplished fact, there were 15 buffaloes out of which two died, one of tympanites and the other of inversion of uterus in spite of the timely medical aid. One of the buffaloes being a poor milker was auctioned off. All these three were replaced by purchasing new animals from Larkana District. The animals thrived very well on green and dried berseem and jawar fodder and were in addition given small quantities of concentrates to the extent of about 4 lbs. per head to animals in milk only.

With regard to hand feeding of young stock some change was made in the feeding table shown in para. 61 of the last year's report. The change was

found necessary because linseed oil for adding to the separated milk in order to make up the loss of butter removed, went very dear. Thus the original idea of economy having ceased to exist the whole milk has begun to be given as under:—

From birth to 8 weeks lbs. 4 whole milk.
From 9 week to 16 weekss „ 3
From 17 to 24 „ 2

The above quantity is given in two meals morning and evening. From the nineth week forward increased quantities of green fodder and crushed peas are given. After six months milk is altogether stopped and the young stock are kept on green and dry fodder alone. Experience has, however, shown that the above quantity of milk is rather too small and that the following table seems to keep the stock much better—

From 1 to 4 weeks lbs. 6
From 5 to 16 weeks „ 4
From 17 to 24 weeks „ 2

As to merits of hand feeding observations point to the young stock not thriving so well as those allowed to suck their mothers yet hand feeding method has the advantage of its own inasmuch as no trouble whatsoever is experienced in milking when young ones die or fall sick not to speak of the accuracy of the figures of milk yield which the system procures.

The total production of milk during the year amounted to lbs. 51,260 while the total sale proceeds come to Rs. 5,262-8-10.

Concerning milk yields the following points are noticeable:—

1. Of the 15 buffaloes the average number of animals in milk throughout the year was only 11 or 73%.

2. The average lactation period of the 15 buffaloes during the year was 273 days while the average milk yield of the whole lot was lbs. 3,417 per head within the year.

3. The highest yield was lbs. 4,871 during the year given by a local buffaloe named "Garhi" purchased on the 17th day of her calving. Thus if we make an appropriate allowance for milk of these 17 days the total yield would rise to 5,200 lbs. which is 50% more than the average of the year.

4. Buffaloe named "Makhni" has yielded 5,753 lbs. during the whole lactation period running in between the last as well as this year. Its maximum yield for a day is 34 lbs. and the maximum yield per month is 940 lbs. which is the highest so far obtained.

5. The average yield of the whole herd of 15 buffaloes for the whole lactation period during the year works out at lbs. 12 oz. 9 per head. Accoridng to the lactation periods the following is the table of milk yield of the animals:—

			lbs.	oz.
1.	Makhni	...	5,752	12
2.	Menghi	...	5,242	4
3.	Susni	...	4,657	0
4.	Suhani	...	4,544	0
5.	Mumal	...	4,505	4
6.	Misri	...	4,077	4
7.	Mithi	...	3,796	0
8.	Moti	...	3,391	0
9.	Manglo	...	3,380	12
10.	Mangal	...	3,370	4
11.	Muni	...	2,927	4
12.	Malhin	...	2,773	0
13.	Rani	...	2,128	12

The remaining two animals died before completing their lactation period.

Education.

57. In 1919 the seventh sessions of the Agricultural School, Mirpurkhas, closed. Five boys sat in the examination, all passed successfully.

Out of these, three have taken up appointments in the department as muccadums and the third as a temporary fieldman. The remaining two have taken to private farming.

The eighth or the current sessions opened in September 1919 and there were 11 boys to start with but in the course of the next two months the number fell to five which is continuing. Those who left either did not like manual work a certain amount of which each boy is expected to do as a daily routine or considered the scholarship (then Rs. 10 a month) too small for their current expenses.

Among the crops successfully grown by the students there were several English and country vegetables and cottons and wheats.

The boys as usual were taken on tour to see representative agricultural tracts of Sind.

The cost of the agricultural school under all heads amounted to Rs. 3,939-11-10 as against Rs. 3,307-2-2 of last year.

The training was on the same lines as those in the previous year. The whole matter of agricultural education has, however, been recently discussed in a Conference under the Presidency of the Commissioner in Sind and a suggestion has been made that there should be two agricultural schools instead of one; one at Ruk for Northern Sind and the other to continue at Mirpurkhas for Lower Sind, with certain modifications in its working. Past experience has shown that sons of substantial zemindars do not generally co ne to join the school and that the smaller men who come do so chiefly with the hope of getting service or land after passing out from the school and when these are denied to them the attendance falls off.

To meet the difficulty in a country like Sind where the notions and ideas of people are so very different from those of the people of other countries in India that special remedies consistent with the people's notion have to be found out and these under the circumstances appeared to be—

(*a*) Influence or pressure.

(*b*) Inducement.

As to (*a*) this can only be exercised by District Revenue Officers and besides being against the spirit of the scheme is so artificial as to slacken at any time. The other alternative is therefore one of inducement which could be effected in several ways such as promise of a grant of land, grant of honours to the father of a candidate and so on. None of these was considered desirable and therefore elementary English education has been suggested as the safest means of inducement; with this important modification that elementary English education should be taught by the direct method to fit the boys for ordinary conversation, reading and writing for which there is an intense desire on the part of zemindars, sons and not as a part of the course followed in schools where school leaving certificate is a qualification for service.

Agricultural Engineering.

58. With the kind co-operation of Mr. Schutte, Agricultural Engineer to the Government of Bombay, we have now a full time Mechanical Superintendent for Sind whose services are available to the general public for advice on matters connected with agricultural engineering such as the erection of pumping plants, boring wells, &c., applications for advice are promptly dealt with and sites inspected where prossible. Boring work started on the Seed Farm, Mirpurkhas, last year has taken rather long time to complete but it is hoped that on arrival of the necessary materials the work will be taken up vigorously by the Mechanical Superintendent. During the course of the year the Superintendent completed testing of a well on the proposed Willingdon Cattle Farm site near Malir.

Government have lately approved of the policy of placing pumping plants in the districts with a view to getting their uses extended in suitable places. Arrangements are on foot to get a couple of such plants suitable for short lifts for demonstration and on their arrival will be shown in working order on the Jamrao canal to begin with.

General.

59. The activities of the Department are increasing year by year. Unfortunately owing to inadequate staff we are not able to do what we want to do. The whole question of the expansion of the Department has been recently discussed in a Committee and certain definite proposals have been submitted to Government and it is hoped that before long the Department would be fully equipped to do justice to the various problems already in hand or to be worked hereafter.

Staff.

60. All the members of the staff have worked well. The senior members have now been showing increased interest in acquainting themselves with the rural and economic condition of the tracts in which they are placed and have begun to contribute useful articles to Agricultural Journal of India and the Poona College Magazine, also writing leaflets and bulletins.

Mr. Umershah, Superintendent, Mirpurkhas Farm, did excellent work during the year and his good farm management together with several other activities involving strenuous work and heavy responsibilities single him out for special praise. He has just proceeded on a long leave and the Department has lost in him, though it is hoped only temporarily, a conscientious and honest worker whom it will be difficult to fittingly replace.

Mr. Ghulam Mustafa, Superintendent, Landhi Farm, also did excellent work in the distribution of potato seed worth over Rs. 21,008.

GULMAHMED, A. R.,
Deputy Director of Agriculture.

Characteristics of Neglectum Varieties in Sind.

Species.	Variety.	Sub-Variety.	Comparative tests of 1919-20. Average yield per acre in lbs. on		Ginning. %	Fibre.	Other Remarks.	Trade opinion.	Valuation per candy.	Basis.
			Mirpurkhas Farm.	Seed Farm.						
1	2	3	4	5	6	7	8	9	10	11
									Rs.	
Neglectum ...	Rosea ...	Rosea ...	1,016	968	38·40	Poor ...	Hardy ...	No staple at all rough in feel good for 6 S.	380	Fine Bengal Rs. 400
„ ...	„ ...	Cutchica ...	648	630	38·40	Poor and wooly.	Not so hardy ...	Do.	380	Fine Sind and Baluchistan „ 400
„ ...	Vera ...	Vera ...	868	693	33·36	Good ...	„ ...	First in point of length, in staple less coarse in feel, good for 10 S.	410	Fine Khandesh „ 410
„ ...	„ ...	Malvensis ...	780	453	33·36	Poor ...	„ ...	No staple at all, rough in feel, good for 6 S.	380	Fine Oomras „ 450

APPENDIX H.

WORK DONE UNDER THE PROFESSOR OF AGRICULTURE, DURING THE YEAR 1919-20.

Staff.

As the Professor of Agriculture has had to assume the duties of the Principal in addition to his usual duties, very little time has been available for any outside demonstrations or for research.

Three stations are directed by the Professor of Agriculture, *viz.*:—The Manjri Sugarcane experimental station of 93¼ acres, the area for instruction attached to the Agricultural Branch of the College of 185 acres and the College Dairy including the fodder farm of 338 acres.

The staff of the last institution has only been sufficient to meet the exacting demands of the dairy courses and the routine administration. The sugarcane experiments of the Manjri Station were practically held in abeyance for the year under report on account of not being able to plant any cane in 9[illegible] owing to a shortage of the water supply in the canal due to the famine. The increase in the number of students at the College has made it necessary to utilize the entire area of the Agricultural Branch for instruction in the various methods of growing crops, so that no area is available for experiments.

A part of this area was loaned to the Plant Breeder for his wheat work. It is thus readily seen that the work under the Professor of Agriculture for the year is not such as would normally appear in a public report, still there are a few things that may prove of general interest. They will be treated by stations rather than by crops.

Manjri Station.—As already stated the regular series of experimental plots could not be planted in January or February. A small area of each of the varieties was kept standing, irrigation being given only once a month and frequent intertillage being performed. An area was prepared for planting and kept ready. As soon as the water was available after the monsoon broke in June, the standing cane was harvested and this area was planted each cane furnishing on the average six sets. The germination was good and the growth rapid. In March of the following year this cane was harvested and used to plant the experimental plots for 1920-21. Six sets were obtained from most of the canes although they were only nine months old. Tillering of the June planted crop was profuse so that for every old cane carried over about 200 sets were obtained or for every acre of cane carried over 600 acres could have been planted the first season after the famine. Had this been generally adopted there need not have been any shortage of sets for planting as was the case. The plots that were to have been planted with cane in 1919 were continuously cropped with maize. Four crops were obtained averaging 13,397 pounds of green fodder per acre.

The rotation crops Nilwa jawar for fodder and the *San* hemp crop for green manure were both sown on irrigation in June as there was no early rain sufficient for sowing at this station. Both made an average growth, the *Nilwa* yielding 5,787 lbs. of dry fodder and the *San* was estimated to have produced 5,141 lbs. of dry organic matter for incorporation with the soil.

The work on varieties was not advanced much during the year although all the varieties have been successively carried over the famine and the classes that were made provisionally were carried over for the verification of the classification.

The Superintendent of the farm of this station was requisitioned for teaching at the College during the year.

College Dairy.—Advancement has been made at this institution in making it better place for instruction. The fodder growing area in Kirkee was thrice or in some cases four times cropped, the average yield amounting 30 to 40,000 lbs. the cost of production being 3½ annas per 100. lbs. The manure is carted

direct from the buyers while quite fresh and ploughed into the soil where "rotting" takes place under the most economical conditions possible as well as under the most sanitary. The area at the Manjri Kuran is used to supply dry fodder and to grow fodder for the young stock.

Guinea grass has been found to be one of the most paying crops as it is a good crop for light soil and can be grown under shade. It yields from lbs. 30,000 to lbs. 35,000 per acre. Berseem is another crop adapted for growing under shed and yields about lbs. 30,000 in three cuttings.

A marked improvement in lessening the mortality of the calves has been brought about largely due to the introduction of the practice of milking the animals without allowing the calves to suck at all. The calves are reared by hand and thereby the milk given them can be regulated to their requirements thus avoiding evils due to over or under feeding.

The mortality has been brought from 80 per cent. or higher down to less than 20 per cent. The cows give more milk, come into season earlier and do not become so reduced in flesh at the end of their milking periods.

The average yields of the year for cows is lbs. 1,460 and for buffaloes is lbs. 1,929. The low yields are due to there being several old animals included in the records whose usefulness as milk producers is over. They have now been disposed of.

Some of the best yields of the year are given below :—

Name.	Total yield of milk in lbs.	Days in milk.	Days in dry.	Total No. of days intervening two calvings.	Average daily yield between calvings.
Cows.					
1. Begum ...	4,412	389	6	395	11·17
2. Eva ...	4,516	451	3	454	9·95
3. Flora ...	4,277	442	1	443	9·65
4. Emma (First calving).	4,450	488	15	503	8·84
5. Mabel ...	4,495	436	111	547	8·22
Buffaloes.					
. Jira ...	5,892	513	116	629	9·37
2. Mahajan ...	5,235	512	146	658	7·92
3. Sajani ...	4,808	420	206	626	7·68
. Agaj ...	4,809	462	174	636	7·56
5. Quinta ...	5,658	536	218	754	7·5

Note that the cows have higher daily yields than the buffaloes.

The cost for grain or concentrate and fodder ration for each lb. of milk is Rs. 0-1-0. 3 for cows and Rs. 0-1-1·2 for buffaloes or one lb. of concentrate given to a cow returns 1·53 lbs. of milk or to the buffalo 1·27 lbs. of milk.

There seems to be no doubt *whatever* that the Sindhi cow is a more economical milk producer than the buffalo. If the milk be taken of average composition, *viz.*, 8 per cent. butter fat for the buffaloes and 6·15 per cent. for cows the butter fat cost of production with the two animals are Rs. 1-0-3 for one lb. of butter fat with cows and Rs. 0-15-0 for buffaloes, or the food cost for buffalo butter is 12½ annas and for cows butter nearly 14 annas.

We now have several strains of Sindhi cows that promise well. Line breeding is being resorted to, to fix the desirable qualities.

The strength of the herd on April first was as below:—

		Milch animals.	Stud bulls.	Young males.	Young Females.
Bos Indicus.	*Cows* ...	40	7	22	52
Bos bubalus.	*Buffaloes* ...	62	3	16	53

Instructional Area of the Agricultural Branch.—The old College Farm is no longer under a Superintendent but its area is divided among the several instructors in crop growing. In order to co-ordinate the labour a head Fieldman is given the duties of filling the labour indents, distributing it and attending to other operations.

As large a variety as possible of crops are grown. The area is divided among the instructors according to the classes which they have to take so that the area can no longer be said to be a Farm but rather a group of Farms. Both irrigated and dry crops are grown. In the statement below are shown the crops, the outturn, labour charges, other charges which includes manure, seed, irrigation, rent of land including assessment, hire of implements, marketing charges, supervision and interest on capital invested, value of outturn and the net profit or loss. The labour prices have gone up and the statement has been calculated at twelve annas which brings the cost high. If one wishes to compare these charges with those of a place where the labour is at a different rate the figures in the labour should be modified accordingly:—

STATEMENT.

Name.	Area.	Outturn.			Cost of cultivation.						Value of outturn.			Profit or loss.		
		Nature.	Principal in lbs.	Secondly in lbs.	Labour charges.			Other charges.								
	A. g.				Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Turmeric mixture—																
Consisting of—Turmeric.	0 20	Rizomes	11,208		133	8	0	207	4	0	389	14	0	49	2	0
Yams ...		Tubers	284													
Guvar ...		Pods	620	400												
Bhendi ...		Vegetables	376	Fodder												
Suran ...	0 10		17,380		104	0	0	636	0	0	814	11	0	74	11	0
French Beans ...	0 10	Drum pods	5,216	4,000	40	0	0	62	4	4	163	0	0	61	11	8
Tomatoes ...	0 10	Fruits	10,460		53	4	0	87	0	0	326	14	0	186	10	0
Onions ...	0 10	Seeds	200	3,180	56	8	0	109	12	0	260	9	0	94	5	0
Bhendi mixture—																
Consisting of—Bhendi ..	0 20	Vegetable	3,784								215	7	0	101	7	0
Raddish...		,,	11,840													
Coriander.		,,	628	Fodder												
Maize ...		Cobs	5,000	4,000	54	8	0	59	8	0						
Khira (Cucumber) ...	0 10	Vegetable	6,872		43	0	0	69	0	0	136	4	8	24	4	8
Leafy vegetables—																
Consisting of—Methi ...	0 20	Vegetable	2,204		46	8	0	59	8	0	50	4	0	54	12	0
Chandanbatwa.		,,	332													
Safflower...		,,	118													
Chakvat ...		,,	172													
Raddish ...		,,	164													
Coriander...		,,	448													
Bajri ...	5 0	Grains	743	5,750 (Sarmad) 770 (Bhusa)	22	0	0	9	0	0	67	7	0	36	7	0
Wheat—Pusa 12 ...	0 10	Grains	650	Not available	28	0	0	25	0	0	50	0	0	3	0	0
Australian ...		,,	160	,, ,,	30	0	0	24	0	0	74	9	0	20	9	0
Punjab 11 ...		,,	332	,, ,,	28	0	0	24	0	0	25	8	7	27	7	5
Groundnuts—Small ...	0 20	Pods	366		51	0	0	35	0	0	30	8	0	55	8	0
Spanish peanuts.	0 20	,,	976		51	0	0	35	0	0	81	5	4	4	10	8
Shalu—Dagadi ...	0 10	Grains	645	2,940 Fodder	24	4	0	17	12	0	43	0	0	11	0	0
Bedari ...	0 10	,,	645	2,580	24	4	0	17	12	0	43	0	0	11	0	0
Dukari ...	0 10	,,	684	3,320	24	4	0	17	12	0	45	9	8	13	0	0
Maldandi ...	0 10	,,	704	3,620	24	4	0	17	12	0	46	15	0	4	0	0
Linseed ...	1 0	,,	534		24	0	0	24	0	0	34	14	0	10	2	0
Gram—Local ...	5 14	Seeds	450		22	0	0	24	0	0	30	0	0	16	0	0
Kaboli ...	1 0	,,	600		22	0	0	24	0	0	50	0	0	4	0	0
Maize ...	1 0	Seeds		4,008	21	0	0	9	0	0	40	1	3	10	1	3
Cottons N.R.— (Farm) ...	0 10	Seed cotton	1,960	1,168 (Stalks)	33	0	0	20	0	0	122	8	0	65	8	0
N.R. (Jalgaon) ...	0 20	,, ,,	1,304	1,184 ,,	31	0	0	20	0	0	81	8	0	26	0	0
N.R. (Ordinary)...	0 20	,, ,,	1,136	1,328 ,,	29	0	0	20	0	0	70	14	0	17	14	0
M.V. ...	0 20	,, ,,	512	928 ,,	28	0	0	20	0	0	32	0	0	20	0	0
N.V.M. ...	0 20	,, ,,	824	1,208 ,,	31	0	0	20	0	0	51	8	0	3	8	0
Bani ...	0 10	,, ,,	228	792 ,,	32	0	0	22	0	0	22	12	9	31	3	3
Camdodia ...	0 20	,, ,,	460	416 ,,	30	0	0	22	0	0	40	0	0	6	0	0
Waghad ...	0 30	,, ,,	660	1,188 ,,	34	0	0	22	0	0	66	0	0	10	0	0
Surat Selection ...	1 0	,, ,,	966	1,372 ,,	33	0	0	22	0	0	96	0	0	41	0	0
Ghogari ...	1 0	,, ,,	736	1,230 ,,	33	0	0	22	0	0	78	9	7	18	9	7

The garden crops have with one exception given a net profit which amounts on the average to nearly seventy rupees per acre. The Kharif jawari was so badly attacked by borers that it was cut green and made into silage. The profits from bajri are more than those from wheat as the latter crop had an attack of rust. The yields of cotton were mostly very high. That of a strain of cotton developed on this farm reaching nearly two thousand pounds of seed cotton.

Distribution.—(*A*) *Implements.*—This Department of the work of the agricultural branch of the College is now quite separate from the farm work and is placed under the Senior Demonstrator. It carries on several lines of work as follows. Demonstrating and selling approved implements kept at the College by various firms. A workshop is maintained for the manufacture of tools and implements devised by the department to be supplied as patterns and for testing and introduction, as for example, the single yoke, the improved yoke, tooth cultivator, tail sheets for attachment to the Sabul plough for earthing up sugarcane or others for attachment to the Gallows plough for ploughing in green manure, improved weeders and improved dumping carts. The petty repairs to the implements on the farms under the Professor of Agriculture are done in this shop and when time permits those of cultivators who send their implements to the shop. College furniture and appartus are made in this workshop when possible. New devices and improvements are also worked out here. The College syllabus requires that each student should have a training in carpentry and smithy which is given in this shop.

(*B*) *Seeds.*—This branch is directly in the charge of the Second Lecturer. It comprises the storing and disposal of the produce of the farm and the purchase of seeds from growers and the distribution of such seeds as well as that grown on the farm for sale. The following seeds have been distributed in considerable quantities:—Lucerne, onion, *San* hemp, groundnut, fodder, jawars, cotton varieties, Akola bajri, vegetables and Guinea grass, sets.

Miscellaneous Work.—During the annual touring with the students the Professor of Agriculture is frequently called upon to give lectures on agriculture at various places and to visit agricultural concerns to give advice.

The following special tours were taken during the year—(1) A tour with Sugarcane Committee to all the principal cane growing areas of the Presidency. (2) A tour with representative of Ransomes Simms & Jefferies, demonstrating the ploughs of the firm. (3) Attendance of the Board of Agriculture at Pusa. (4) Deputation to the Nagpur tractor trials to act as judge. (5) Again deputed to act as Examiner at Nagpur. (6) The Christmas holidays were spent working with the Agricultural Engineering testing tractors. It was early seen that these test trials require both Engineers and Agriculturists. A full joint report has been made and I would only like to add that before tractor cultivation can be a success it is necessary that some men who are agriculturists and who know the theory and the practice of ploughing should be given a training in driving tractors and the ordinary care of the same. Motor drivers, fitters and Engineers do not readily learn to plough.

J. B. KNIGHT,

Professor of Agriculture.

APPENDIX I.

ANNUAL REPORT OF THE OFFICE OF THE AGRICULTURAL CHEMIST TO THE GOVERNMENT OF BOMBAY, POONA, FOR THE YEAR 1919-20.

During the year under report, *viz.*, from the 1st of July 1919 to 30th June 1920, I was in acting charge of the Office and Laboratory of the Agricultural Chemist to the Government of Bombay.

2. The routine work of the Laboratory was as usual and the number of samples received during the 12 months under report is given in the following table. Numbers of samples of the previous two years are also given for comparison :—

1917-1918	...	1,278
1918-1919	...	1,162
1919-1920	...	1,355

3. The character of the analyses done is shown in the following list for the period under report :—

Nature of samples.		Number of samples.	
		1918-19	1919-20
Soils	...	610	411
Manures	...	218	248
Feeding stuffs	...	91	131
Waters	...	102	388
Gul and Sugars	...	6	7
Oilseeds and Oils	...	11	40
Dairy products	...	16	25
Fruits and Vegetables	...	15	26
Miscellaneous	...	93	79
Total	...	1,162	1,355

4. As in previous years the success of the Laboratory in filling a public need could best be shown by the use made of it by the public, both by actual cultivators and by those responsible for industries directly dependent on agriculture. The number of samples received for analyses from the public as distinguished from those from the Government Farms and Departments continues large and was as follows during the 12 months under report. The number of samples in the previous year is also given for comparison :—

Nature of samples.		1918-19.	1919-20.
Soils	...	61	65
Manures	...	166	119
Feeding stuffs	...	35	42
Waters	...	26	62
Gul and Sugars	...	*Nil*	1
Oilseeds and Oils	...	11	27
Fruits and Vegetables	...	3	*Nil*
Dairy products	...	5	21
Miscellaneous	...	86	56
Total	...	393	396

5. Samples received from the public compare with those received from the Government Farms and Departments as follows :—

Nature of samples.		Government.	Public.
Soils	...	346	65
Manures	...	129	119
Feeding stuffs	...	89	42
Waters	...	326	62
Gul and Sugars	...	6	1
Oilseeds and Oils	...	13	27
Dairy products	...	1	24
Fruits and Vegetables	...	26	*Nil*
Miscellaneous	...	23	56
Total	....	959	396

6. The nature of the routine work done was nearly of the same character as in previous years. The general demand for examination of and opinion upon the suitability of land for special purposes and causes for the deterioration of land, value of waters, especially when newly brought into use for irrigation purposes, suitability of particular manures and other problems in connection with cultivation, examination of feeding stuffs, oils, oilseeds and other similar matters, is also included in the usual work of the Laboratory.

7. In the last year's report it was said that the detailed study of Manat lands would be taken up in hand and I am glad to say that a beginning has been made and we shall be in a position to say something definitely with regard to their peculiar character. A few samples of Manat soil were received even this year and analysed for their chemical and mecha ical constituents. The Economic Botanist sent some samples of soils in which different kinds of Leguminous plants were grown and also sent nine samples of wild Leguminous plants. The results of the analysis would be published by him along with the experiments he is carrying out.

8. Samples of ordinary and milled guano produced at the Departmenta Experimental Station at Malaji were sent by the Superintendant of Fisheries, Southern Range, Karwar. They give a high percentage of nitrogen and phosphoric acid.

9. Shevri leaves and Shevri stalks were received in the Laboratory for analysis as feeding stuffs. The leaves were found to be better than the young stalks as was expected although the tender stalks also were found to be a good feeding material for animals.

10. Two samples of Australian mutton tallow were sent by a firm in Bombay They were genuine and had the usual white colour, granular consistency and the characteristic odour.

11. So far only a very few samples of vegetables were analysed in this Laboratory but this year the Inspector of Agricultural Schools sent a large number of typical vegetables for analysis. I expect to publish these results in the College Magazine.

12. At the beginining of the period under report famine conditions were in existence and a number of inferior food stuffs were sold in the markets. Materials that were suspected to be injurious were sent for analysis either direct or through the Chemical Analyser to Government.

13. Several samples of coloured earths were sent to determine whether they would be useful colours. Many of these were found to be good material for paints.

14. A gentleman from Kathiawar sent some *Khars* (salt deposits) for full analysis. They contained sodium carbonate and chloride in the soluble part ; while the insoluble part was mostly calcium carbonate and sand.

15. Besides the above samples of soils, manures, food-stuffs, cooking oils, &c., samples of boiled linseed oils, varnishes, inks and other miscellaneous samples were analysed.

16. All the time that could be snatched from the routine Laboratory work and the increased teaching was fully utilised for investigation work. The results of some of the investigation problems have been or are being published.

17. Mr. V. A. Tamhane who was deputed to Sind last year as Special Agricultural Chemist to examine the probable effect of the proposed Sukkur Barrage Scheme on the development of salt land in Sind, completed his investigation work during the period under report and the results of his investigation are being published as a Bulletin of the Bombay Agricultural Department.

18. The study of the deterioration of the cardamom cultivation and the soil in the spice gardens of Sirsi, North Kanara, was taken up after the publication of a Bulletin on "the spice gardens at Sirsi" for further investigation. This now is nearing completion of the first stage and before the end of the year the results will be ready for publication.

19. Investigation of the Manat soils in Konkan has been taken up by Mr. N. V. Kanitkar, Acting Assistant Professor of Chemistry. He has done chemical and mechanical analysis of a number of typical samples and would now devote his attention to the determination of colloidal matter in them.

20. The whole of the Central Division of the Bombay Presidency is covered with trap which gives various types of soils. Investigation of the decomposition of the trap rock would be valuable in several ways and hence Mr. N. V. Kanitkar and myself have taken up the study of the decomposition of the trap rock under different treatments. Two types of trap rock have been selected for work. Each of these is treated with 1) water, (2) water saturated with oxygen, (3) water saturated with carbon dioxide, (4) fifth normal solution of sodium carbonate, (5) fifth normal solution of hydrochloric acid and (6) fifth normal solution of citric acid. Uniform size particles of the rocks are shaken with the above reagents in bottles and the extracts are analysed every month. Some definite results would be available next year.

21. For many years past Poona City has been notorious for its inadequate and unsatisfactory supply of milk. It was thought therefore, useful to know something about the condition of milk supplied to Poona City, under the most trying circumstances that were in existence at the end of the last famine. Mr. V. N. Gokhale on the staff of the Agricultural Chemist and myself collected and analysed a number of samples of milk and the results were published in the Agricultural Magazine in July 1919. It was found that no milk sold at any rate above four lbs. a rupee was genuine, that sold at five lbs was adulterated to the extent of nine parts of water per 100 parts of milk; and that sold a lbs. 10 to 12 was adulterated with quantities of water varying from 202 to 432 parts per 100 parts of milk.

22. Eradication of weeds is a very important problem. A few trials were made during the last two years on a small plot behind the Chemical Laboratory to find out if it was possible to eradicate with the help of chemicals "*flaveria contrayerba*"—a hardy weed belonging to the Compositæ Order. The plants were treated with (1) copper sulphate solution; (2) ferrous sulphate solution; (3) arsenic plant poison; (4) bittern; (5) dilute sulphuric acid; and (6) hot water Various strengths of these were used. Five per cent. copper sulphate, two per cent sulphuric acid and hot water proved to be effective in killing the weed. Detailed results are published in the Agricultural College Magazine of October 1919 and January 1920.

23. At and near about Amalsad in Surat District the sugarcane suffers from *red-rot* in September and October. Mr. G. S. Kulkarni, Acting Assistant Professor of Mycology, who is investigating the cause for sometime past, wants to find out whether at any period in the year the soil or the irrigation water contains any injurious salts. Mr. V J. Atgur of the Chemical Staff has taken up the problem. At the end of one complete year his results will be available.

24. Mr. V. N. Gokhale is studying the changes in the various constants of "butter-fat" in different parts of the lactation period.

25. Besides the large and small investigations mentioned above Dr. H. H. Mann is carrying out a very important investigation in connection with the "rotting of potatoes" especially the chemical changes accompanying it. The results of this research are put together for publication.

26. The following papers which were read at the last Science Congress at Nagpur in January last, are being published in the Pusa Journal of Agriculture :—

(1) A preliminary note on the effects of waterings on the amounts of acids secreted by the gram plant—by myself.

(2) Comparison of salt lands in the Deccan and in Sind—by Mr. V. A. Tamhane.

(3) Gul-making from juice of date-palm (*phœnix sylvestris*) in the Thana District and the improvement in the quality of Gul—by Mr. V. G. Patwardhan.

27. Mr. V. G. Patwardhan, Acting Lecturer in Chemistry was deputed to work at Talegaon to assist in the Scheme of milk supply to Poona City and therefore, his study of the Chemistry and Physiology of Betel-vine leaves had to be postponed. The work at Talegaon was closed in the 1st week of May last. Mr. B. H. Patil who is a graduate under training was deputed for water-finder work from November 1919 to June 1920.

28. During the absence of Mr. V. A. Tamhane in England, Mr. D. M. Ranade is acting as Senior Laboratory Assistant since January last. All the members of the Laboratory worked satisfactorily.

29. The College teaching work is steadily increasing for the last three years and this year it is double of what it was three years ago. This increase of work is due to the increase in the courses on one hand and the increase in the number of students on the other. The pressure of increased work was felt in all the branches of the College and was reduced by additional staff in almost every branch and it is hoped that the pressure on the Chemical Section would also be reduced by the appointment of a Demonstrator in Chemistry. It is with the help of such hardworking men as Messrs. N. V. Kanitker and V. G. Patwardhan that I am able to pull the students through their courses.

D. L. SAHASRABUDDHE,
Ag. Agricultural Chemist
to the Government of Bombay.

APPENDIX J.

WORK DONE UNDER THE ECONOMIC BOTANIST FOR THE YEAR 1919-20.

Staff.

From the beginning of the year under report till 1920, Mr. S. L. Ajrekar, B.A., acted as Economic Botanist. On return from leave I resumed my post as Economic Botanist, and Mr. S. L. Ajrekar went on leave. Mr. G. S. Kulkarni continued to act for Mr. Ajrekar till April 6th when he went on privilege leave till 16th May 1920, his place being filled by Mr. B. N. Vakil, M.Sc.

Mr. P. G. Joshi, Superintendent of the Ganeshkhind Botanical Gardens, went on two months' privilege leave on April 16th, 1920. Mr. H. P. Paranjpye was appointed to the staff of the Cotton Expert, Baghdad, Mesopotamia, on the 30th October 1919, and his place was taken by Mr. G. C. Limaye, B.Ag., who resigned on April 15th.

Education.

There were seven men who specialised in Advanced Botany for their degree in the year under report. All these passed. The instruction given to these men in Plant Breeding has been much improved and brought up to date, and similar improvements will take place in the teaching of horticulture and ornamental gardening. This improvement will be accelerated by the acquisition of the garden of about 11 acres, known as Modi Bag, contiguous to the College estate. This land is now being cleared and fenced, and within a year ought to be ready for the work of students.

The slowness of the P. W. D. in getting at the construction of the necessary buildings is a retarding factor.

A special tour was made by the above-mentioned seven men to Dharwar, to see cotton breeding and cultivation.

The arboricultural course was again not held this year as a sufficiently large number of P. W. D. subordinates could not be sent. It appears as if this course were no longer wanted, this being the second year in which enough men have not been available.

The horticultural course in Ganeshkind Botanical Garden was attended by six men, two of whom were " malis-in-training, " receiving a wage. All passed in their final examination. There is a belief abroad that these posts of "malis-in-training" are scholarships which can be bestowed on any one. Certain well-to-do people of the upper classes apply for them. They are intended for malis only and will be kept for such.

The teaching work at the College requires no special remarks. A large grant for additional apparatus is being spent and it is hoped that the efficiency of the botanical section will thereby be increased.

Research Work.

Most of this is contained in detail in the annual report of the Ganeshkhind Botanical Garden, and in various articles and bulletins issued by the Economic Botanist. The following are brief summaries:—

Mango.—Great progress has been made in bringing stocks into condition for grafting much earlier than can be done in the local methods.

The growth of mango seedlings in the ground from the start is better than growing them in pots and then transplanting.

This is a confirmation of results got in the years 1913 and 1914.

The top-working of mango trees continues to be successful in the Konkan. In the Deccan precautions have to be taken against sun-scorch.

The whole of our present knowledge of the mango has been embodied in a book by Dr. Burns and Mr. S. H. Prayag, M.Ag., entitled "The Book of the Mango," which will shortly appear from the Government Press.

Citrus.—The packing of citrus scions for despatch overseas was the subject of experiment. Scions sent to Singapur arrived on the whole in bad condition, although packed in sterile and damp material.

In citrus, as in mango, we have been able to reduce the length of time that the stock takes to be ready and the length of time that the finished budded plants require. We can now produce a plant ready for planting out in 11 months from the sowing of the seed of the stock.

In Ganeshkhind Garden two old citrus plantations have been cleared out to give room for new experiments.

Guavas.—The advantages of pruning have been clearly demonstrated in several varieties. The pruned plants may produce somewhat fewer fruits than the unpruned, but this is more than made up for by the greater size and uniformity of the fruit and the even bearing. The plants are much more under control, when pruned. Plant trained in espalier shape on wire have given good yields of well-shaped large fruits. The carrying out of this system has been somewhat faulty and the plants will be re-shaped this hot weather.

Guava trees planted in blasted pits in rock in the year 1915 have taken hold well. Examination of their roots reveals that they have been penetrated the crevices of the shattered rock. The plants need more water than those in normal soils, and bear fewer fruits.

The Sind-Hyderabad variety with few and soft seeds is in great demand.

Papaya.—Breeding has been done for three generations to see if it were possible to fix a race with a large proportion of female plants. In the third generation a large proportion of males has re-appeared so that our work has not been successful. We have, however, got a good deal of scientific information.

The Washington variety, introduced by us, is in great demand.

Grapes.—The vines suffered from a bad attack of anthracnose (the fungus *Gloeosporium ampelophagum*) and only repeated sprayings with a mixture of lime-sulphur and Bordeaux mixture saved the trees and the crop. For mildew, experiments in the rains showed that Bordeaux mixture was much more effective than ammoniacal copper carbonate or potassium sulphide.

One hybrid grape (Neelum × Bhokri) is doing well and proves to be a real hybrid.

Some of the foreign varieties have flowered and fruited and we were thus enabled to estimate their qualities. None is strikingly superior. This is probably due to their not being yet acclimatised. Our own grape varieties with the exception of the Pandhri Sahebi (which is probably an acclimatised foreign grape) are not strikingly good either. They lack in flavour and juice.

The cause of this will be the subject of experiment when the new horticultural branch is formed.

The Pandhri Sahebi mentioned above is a variety of excellent quality but poor bearing capacity. The bearing capacity has been improved by growing the plant on an extended trellis system as against the bush or umbrella system which suits most of the other varieties in this part of India.

Banana.—A thorough test of three manurial programmes is being made.

The manurial methods being tried are:—

(1) A formula devised by Dr. Mann containing artificials.

(2) The local practice plus the ash of the weeds and old stumps.

(3) The local practice plus a mulch of the rotting weeds and old stumps.

It is as yet too early to say what the results will be, but flowering has been earlier in the plots treated with artificials.

Study has been made of the factors influencing the orientation of the banana bunch and it appears that the main factor is the lack of roots on the cut surface of the planted corm. This means less anchoring on that side, a tendency to lean to the other side, and hence the appearance of the bunch on that side This matter is being gone into further.

The drying of bananas has been most successfully accomplished a product of excellent colour, taste and keeping qualities being manufactured. It now remains to develop a market for this product, and this is not the function of the botanist.

Wild Fodder Grasses.- The plots under experiment in the compound of Government House, Ganeshkhind, Poona, have given excellent yields and the perennial grasses are becoming established. The species that prefer different kinds of lands are being classified, according to these preferences. It now appears that certain annual grasses of rapid growth are necessary in the first instance to kill out spear grass and to act as nurse plants for the perennials. Later these annuals also disappear and the perennials remain, which is what is desired.

A new area at Kalas of seven acres of the worst possible Deccan land, uneven, shallow and eroded, has been taken up on a five years' lease to determine whether we can similarly improve the grass of such a spot. We are confident that we can. The experiment will be watched and the vegetation analysed botanically and chemically as it improves. This type of investigation has received the seal of approval of the Board of Agriculture of India, which met at Pusa in December 1918, in their Resolution XIX. The matter is of vital importance from the point of view of fighting famine.

Similar study of grass land and its improvement is being made by us at Chharodi, at Tegur and near the College of Agriculture, Poona. It is hoped largely to extend this work by the aid of funds recently granted by the Sassoon David Trust Fund.

Advisory and Demonstration Work.

The amount of assistance given and the variety of questions answered tend to increase. The following are a few of those received to indicate the kind of work done :—

Some subjects of which advice has been given either by letter or personally on the spot :—

Horticultural literature in English and Vernaculars.

Seeds and plants for the Bureau of Plant Industry, U. S. A., and other foreign Departments.

Sites for fruit plantations.

Renovation of neglected fruit plantations.

Sisal hemp planting.

Identification of specimens for medico-legal enquiries.

Identification of Botanical specimens for amateurs and professionals.

Grass improvement.

Plants for industrial alchohol.

Plants for paper making.

New fodders.

Planning and replanning public and semi-public gardens.

Valuation of fruit plantations for legal cases, &c., &c.

The extraordinary variety of the work done is worth noting. We are in all cases able to do something and in most cases to give complete satisfaction.

One member of the staff has been set aside specially for district work, touring and advising. This naturally means that he is not available for his other work and proposals have been made to the Director of Agriculture for the strengthening of the staff by a full-time District man.

The above does not include the many inquiries on plant diseases.

Mycology.

The Tambera Disease of Potato.—The study of this disease was completed. Inoculation experiments both in the laboratory and in the field conclusively proved that the disease was caused by a mite and would be easily controlled by sulphur treatment. In the coming year experiments will be undertaken in the potato tract to demonstrate the treatment. A paper on this disease in collaboration with Dr. Mann and Mr. Nagpurkar was submitted to the Science Congress held at Nagpur in January 1920.

Potato Rots.—Inoculation of potato tubers and plants with the pure cultures of *Rhizoctonia solani* did not yield any results. The "Black rot." of potato, described in last year's report to this fungus has been found to be caused by the same agency as that of "Black heart" described in American literature *viz.*, heat. A new *Fusarium* which produces brown discoloration and rotting inside the tubers has been isolated. Observations on the dry rot fungus (*Fusarium trichotheciodes*) of the tubers show that the organism thrives well between the temperatures of 25° and 30° C.

The Tambera Disease of Citrus Trees.—This disease which was till now erroneously diagnosed as Scab has been studied and evidence has been obtained to show that it is also a mite disease. The disease is found on most of the citrus varieties, especially on the Santra and Musumbi, attacking tender roots, leaves and fruits. The fruits are discoloured and thus their market value is much reduced. It is hoped to publish an account of this disease soon.

Smut Disease.—In America *milo* varieties of jawar (*Andropogon sorghum*) are said to be resistant to all kinds of jawar smuts. In order to test this statement two varieties of *milo* (Standard and Dwarf) were tried. It was found that both the varieties were resistant to the grain smut (*Sphacelotheca sorghi*) and not to the loose smut (*Sphacelotheca cruenti*). Experiments will be repeated in the coming year. Smut on Banti (*Panicum frumentaceum*) has been recorded and its life history will be studied along with that on nachani (*Eleusine coracana*).

Mildew or *Jiru* (*Cuminum ciminum*) has been completely controlled by one spraying with Bordeaux mixture when the crop was about two months old.

The Sclerotial Disease of Rice was brought to our notice for the first time near Bhandup in the Thana District, where it is said to have spoiled the crop in more than 1,000 acres.

The campaign against the *Koleroga* or *Gal* disease of the Supari palm was continued as in previous years. The number of trees sprayed was nearly 20,000. The work has become popular and is being taken up wherever it has been demonstrated. Considering the severity of the disease and the vast area it affects progress will be very slow if the attempts are to be continued on the present lines. In order to achieve rapid progress organised efforts are requried. A note on this problem has been submitted to the Director of Agriculture.

Miscellaneous.

The Economic Botanist, Dr. W. Burns, was appointed President of the Botanical Section of the Indian Science Congress which met at Nagpur in January 1920.

Mr. G. S. Kulkarni submitted a thesis (for M.Ag. Degree) to the Bombay University embodying the results of his many years' work on the diseases of jowar and other plants together with his research work on Tambera disease of potato written in collaboration with Dr. Mann and Mr. Nagpurkar. This was approved.

Publications.

The following are the publications issued during the year :—

By Dr. W. Burns, Economic Botanist :

(1) Grass land in the Bombay Presidency, article in the "*Times of India*" October 24th, 1919.

(2) Some Aspects of Plant Genetics: presidential address to the Botany Section of the Indian Science Congress, Nagpur, 1920, published in the Agricultural Journal of India, May 1920.

(3) Variation in Bombay *Strigas*: Journal of Indian Botany, Vol. I, Nos. 6 and 7, March 1920.

(4) Work: Poona Agricultural College Magazine. In collaboration with Mr. P. G. Joshi.

(5) The Drying of Bananas: Agricultural Journal of India, Vol. XV, Part II, March 1920.

One other article in collaboration with Mr. Joshi another in collaboration with Mr. L. B. Kulkarni, L.Ag., and one more in collaboration with Mr. P. G. Dani, B.Ag., have been accepted for publication by the Agricultural Journal and will be mentioned in next year's report.

By Mr. G. B. Patwardhan, B.Sc.:

(1) Strawberry cultivation in the Deccan: Marathi article in the Shetki and Shetkari, July 1919.

(2) A brief note on the work of Spraying Vines in the Bombay Presidency from 1909 to 1918: Poona Agricultural College Magazine, July 1919.

By Mr. R. K. Bhide:

(1) A new species of *Ischæmum* from Bombay: Paper read at the Indian Science Congress, Nagpur, 1920.

By Mr. L. B. Kulkarni, L.Ag.:

(1) Adaptability of wild fodder grasses to certain classes of soi and their utility in Mal (poor) lands of the Deccan. Paper read at the Indian Science Congress, Nagpur, 1920.

By Mr. S. H. Prayag, M.Ag.:

(1) Influence of stock and scion and their relation to one another: Paper read at the Indian Science Congress, Nagpur, 1920.

By Mr. G. S. Kulkarni (in collaboration with Dr. H. H. Mann and Mr. Nagpurkar).

(1) The Tambera disease of Potato: Paper read at the Indian Science Congress, 1920 and published in Agricultural Journal of India, Vol. XV, No. 3, May 1920.

In addition there are in the press an article by Mr. P. G. Dani on Bananas and an article by Mr. S. H. Prayag on "Some observations on the inflorescence and flowers of the grape".

Remarks.

It is hoped in the near future the proposals made by the Director of Agriculture for the development of the mycological and horticultural branches will be sanctioned. When these departments are formed we shall have a section of Plant Industry unequalled in India.

W. BURNS, D.Sc.,
Economic Botanist
to the Government of Bombay.

APPENDIX K.

ANNUAL REPORT OF THE PLANT BREEDING EXPERT FOR THE YEAR 1919-20.

Staff.

I was in charge of the office throughout the year. After a long waiting, I was able to secure the services of two graduates during the year under report on the usual scale of pay to assist me in conducting my work. The three non-graduate fieldmen recruited in the previous year have done very good work and one of them, Mr J. H. Athalye, has proved himself indispensable to me.

Plan and General Conditions of Work.

No change has been made in the plan of work during the year under report. Karjat has proved a very suitable station for rice-breeding. The absence of buildings at this station is a great handicap. Some relief however is excepted to be felt when those already provided for in the budget of the current year will be ready. At Poona, I have neither a piece of land nor a place of work permanently provided for me. The work will certainly suffer if such conditions continue much longer.

Progress of Work.

Rice.—The season was favourable throughout the growing period of rice. I was not, however, in the best of my health, at the time of harvest. I wanted to judge by the eye the various cultures as they stood at harvest time and take notes regarding their field characters at that time. It is much to be regretted that I could not do it. It is further to be regretted that there is no understudy to whom, at such a juncture, I could turn over the work with confidence. Observations made by me on the harvested crop later on have, however, led me to believe that the different varieties of rice grown in the Presidency are not all of them equally rich in strains. One variety, called Garvel, was found extremely homogeneous, and at the other end stood Kolamba in which it was quite easy to make out several strains at a glance. Kolamba rice has of late rapidly gained favour with the cultivators in the central parts of the Presidency. Accurate figures are not available, but inquiries made by me while on tour have led me to conclude that this variety may be occupying about 500,000 acres, an area which represents about one-third of all the lands under rice in the Presidency proper. Taking the above mentioned facts into consideration, I have proposed to concentrate my attention on the Kolamba. I have grown for the Kharif season of 1919-20 about 175 single, plant cultures of the variety. They are ultimately derived from samples collected in previous years from all the rice growing parts of the Presidency except the extreme south where neither Kolamba nor any other fine variety of rice is grown to any extent. Each culture is grown in two parallel rows. Each row has just fifty plants in it. All the rows in a field are placed one foot apart and the plants in a row have a distance of six inches left between them. The cultures are repeated in seven or eight places. If everything goes well, I should get by this system of multiple repetition very reliable data regarding the differences in the yielding capacity of these cultures. I have again repeated this year the process of examining fresh commencial samples with a view to discover some strains that may be superior to anything I have come across so far. It is too early to make a definite statement at this stage, when the plants are only about seven weeks old, but observations made so far indicate that I may be able to isolate from a sample derived from a village called Nana Vaghchhippa in Pardi Taluka of Surat District a strain of Kolamba that may be superior in yielding capacity to all the other strains that I have got on the station. The samples were supplied this year as in the previous years by the Mamlatdars for which my best thanks are due to them. I got together this year 175 samples through their good offices. They come from as many villages, scattered over all the Kolamba growing districts of the Presidency. They are grown just like the pure

cultures. The individual plants have been kept separate in the seed beds as well as in the transplanted fields so that the behaviour of each plant can be studied throughout the growing season.

Wheat.—Wheat was grown on two plots widely separated from each other on the Agricultural College Farm at Poona which were kindly spared by the Professor of Agriculture, for the purpose. The season was on the whole favourable. About a thousand cultures were sown separately. Each culture occupied three rows ten feet in length. The rows were placed one foot apart and a distance of three to four inches was kept between the plants in a row. Between two cultures, a row of Khapli wheat was sown merely to demarcate quickly the different cultures for the purpose of taking field notes. This is the growing period. Attention was paid almost exclusively to the hard yellow macaroni wheat since during the wheat that is most extensively grown in this Presidency. This wheat is grown mostly without irrigation. The thousand cultures will be reduced next season to about three hundred, rejection of the rest being made on the basis of notes taken in the fields and in the laboratory. One particular number, 447, was found to easily surpass the rest, in vigour of growth at all stages. It was also superior in tillering power and in yield of grain. The grains were of a good size but they lacked in brightness and did not possess the right colour. The number will be followed with special interest in the future years.

The work of crossing in rice and wheat has not yet been undertaken. It is necessary for one to know his material to be sure that it is pure before he does any crossing work on it. It is proposed to do some crossing work with the standing strains of rice.

H. M. CHIBBER,
Plant Breeding Expert.

Poona, 29th July 1920.

APPENDIX L.

ANNUAL REPORT OF THE AGRICULTURAL ENGINEER FOR THE YEAR ENDING THE 30TH JUNE 1920.

During the year under report I was on leave for a period of seven months, and took over charge of the Agricultural Engnieer's office from Mr. Thiselton-Dyer on the 26th November 1919.

I found on my return a number of changes in the organization and working of my Department a reform which I had advocated for a long time, and which I had to leave on one side, owing to excessive pressure of work including Mesopotamia, and the famine schemes, all of which told upon my health.

I had an attack of small pox, and ultimately was ordered to England to recuperate.

Mr. Thiselton-Dyer realised the vast amount of work I had to do, and considered it almost equal to that of four Executive Engineers'. He naturally considered my establishment inadequate, and the original system of accounts and general procedure in the office—which was meant for a small establishment—inefficient. The Accountant General, whose assistance was therefore sought, suggested new forms on the P. W. D. system. All these are not yet to hand from the press; but I am afraid that the present establishment will be found absolutely inadequate to cope with the new system of work.

I very much regret that a misunderstanding has arisen, due to the inspection of this Department by the Accountant General during my absence, which has led to the belief that my Department endeavoured to do infinitely more than it was capable of under ordinary circumstances. This may be true to a certain extent, but the times were such that I was practically forced in spite of an inadequate establishment, to meet the extra work caused by the increasing demands of the public, the war, and ultimately a first class famine. Consequently the niceties of office routine work became very much neglected and I found it absolutely impossible to adhere strictly to office and Store management and also to attend to the enormous amount of executive work as well. The questions raised during the inspection would appear to discount the useful work done, and the amount of energy spent. Nothing has discouraged me more than to find this state of affairs on my return to duty, and it has naturally led me to attend to office routine first and the real work afterwards.

I shall now narrate in brief the work done during the past 12 months.

POWER PUMPING.

There were several inquiries in this connection during the year under report; but practically none developed as regards private installations, due to abnormal and uncertain conditions in the price of machinery.

Twenty-three plants were fixed by the Department for various famine works. Five of these were comparatively large ones, and fixed on the rivers Nurbada, Godawri, Krishna and Bhima which alone produced 875 acres of fodder crop. The rest were comparatively small and the total area irrigated by all of them, including the above five, amounted to 2,000 acres. All these had to be fixed in a very short time, and there were no end of difficulties in the way which had all to be quietly encountered and overcome—obtaining sufficient quantity of fuel, and conveying it to several places in time—transportation of large machinery to different places by railway and road without any breakage-fixing it in time—completing the water distribution on quite new land, and starting the irrigation. All this gave no end of trouble, and meant a vast amount of work.

There was also great difficulty in getting competent and reliable men to work the machinery. This was however accomplished with the hearty co-operation of the staff and their willingness to work even at night time without any extra remuneration. The number of inquiries for pumping and mechanical cultivation has considerably increased owing to the great scarcity and dearness

of animal power, but the abnormal prices have hampered the construction of these installations to a great extent although their want is very keenly felt.

Had prices been down, I am sure that we could not have dealt with any extra demand with the present establishment. With a view to bring about better results, effect better supervision and meet with the rising demands of the Rayat. I have proposed that the Executive work be divided into four or five sub-divisions with a responsible officer in charge of each, he should have an adequate staff and thus able to give more effective help in time and advise the Rayat in case of necessity. Proposals in this direction have been submitted and I am awaiting the orders of Government.

Boring.

There have been many inquiries regarding Boring during the year under report and the Department has been very busy with this work, particulars of which are contained in Statement II attached herewith.

The number of inquiries have greatly increased on account of the recent famine, but the Department was quite unable to meet all the demands from the cultivators in the absence of a sufficient number of machines and adequate staff.

The Department possesses 48 machines (including hand and power) against 188 Talukas in the three Divisions of the Presidency, excluding Sind, where one machine is already working for experimental purposes. This shows that one machine roughly covers four Talukas, whereas of necessity there must be at least one machine for each Taluka to cope with the urgent needs of the public. The work in this section is for the present managed by three suborbinates, excluding Sind, where there is an officer of the Mechanical Superintendent's grade, in charge of both the boring and other sections of the Department. But if a greater number of machines are engaged, three more suborbinates will be absolutely necessary and proposals in this connection have already been submitted.

Statement I, will show the work done by this Department in this connection, *viz.*, the number of bores made, the number of gallons of water tapped, and the total depth bored. Latest reports from the works carried out at Kurduwadi in the Sholapur District show that there is a great possibility of tapping an abundant supply of water in that locality. Thana District has also shown excellent signs in this respect.

I am anxious that private agencies should come forth and take up this work. A few Local Boards have made an effort in this direction, but have not been very successful. Nevertheless there is no reason why they should not do it quite as well as this Department.

Hand power boring machines have been found very ineffective, and I have gradually started to convert each of them into power driven machines as the funds allow.

Steam Plough.

There have been a good many changes in this respect. When the first tackle, purchased from the Sassoon Fund was sent to Mesopotamia, the one in Gujarat, was brought over to Rahuri in the Nagar District. We were not able to work it for the required number of days in the last season, as it was decided late where to send it. However we have ploughed 427·18 acres of black cotton soil 16″ to 18″ deep at Rs. 30 per acre. The total number of receipts amounted to Rs. 12,823-8-0 and the actual expenditure incurred, including fuel and oil charges, sundries and establishment charges for six months only—assuming the staff can be used for outside work as usual in the off season—was Rs. 11,705-7-9 thus effecting a net profit of Rs. 1,118-0-3 on the whole concern, exclusive of interest and depreciation.

This is a fairly good result considering that this tackle was not meant for deep ploughing as a radical change in the gear-ratio is necessary and this I am going to effect with the help of the manufacturers, if possible, before we start operations again.

If Steam Ploughing is to be continued by this Department, the tackle must be used for other work such as road rolling, stone-breaking, &c., in the off season, and thus keep the staff fully engaged. If this can be satisfactorily effected, I anticipate a great saving in the running expenses and the engines may be employed for eight instead of four months out of the twelve. Tackle like this should now be worked by private agencies, leaving the Department free to devote its energy to some other useful work.

Tractor Trials.

I have devoted a great portion of my time to the taking of a series of trials with motor tractors of different makes, on different soils, and the result as given in Statement III will give some idea of what has been done.

Out of three (Case Mogul and Fordson) tested, I found the first most useful for all soils and under all conditions. The percentage of slip is "nil" and the tractor runs very smoothly and quietly with a Detour Plough on heavy soil. The consumption of kerosine is very low (approximately 8 gallons per acre) and the total cost of ploughing 7″ to 8″ deep on hard land amounts to Rs. 7 to 8 only, and the time required to plough one acre is 2 hours 30 minutes.

The Mogul is fairly good on medium soils, when ploughing 7″ to 8″ deep, and pulling a two furrow 14′ bottom plough. The running cost amounts to Rs. 9 to 10 per acre. The design however is old and open to much improvement.

The Fordson is fairly satisfactory on very soft soil when ploughing 6″ to 7″ depth with a 2 furrow plough. But the hind wheels slip on black or medium soil at 7″ to 8″ deep and there is an excessive use of kerosine. There is badly a danger of the front end lifting and consequently endangering the driver's life should the hind wheels lock. Nevertheless this tractor has many points in its favour. I have not as yet completed the trials with the Sanderson which only arrived recently, and I cannot as yet definitely say what type of machine is most suitable for this country for different soils.

The caterpillar type of plough has to be tried and this may put a different aspect on the whole business.

I believe there is a great future for the tractor in this country, but at present it is purely propaganda work.

I strongly urge that my time be devoted to experimental and research work and that the Executive part be taken over by private agencies in which case my present staff will be enough for my requirements. I have nothing but praise for the members of my staff who have worked well and who, I believe, have the interests of the Department very much at heart.

W. M. SCHUTTE,

Agricultural Engineer, B. P., Poona.

STATEMENT No. I.

Detailed Statement of Bores taken during the year 1919-20.

Serial No. Bores.	Name of Well-owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring per hour gallons.	Water after boring per hour gallons.	Departmental charges.	Labour charges.	Total cost of bore-hole.	Cost per foot.	Result and Remarks.
	Kaira District.			Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	Mr. Mangalbhai Veribhai ...	Mehmedabad ...	Aklacha ...	3	73 0							Unsuccessful.
2	,, Veribhai Vaghajibhai ...	Nadiad ...	Nadiad ...	3½	142 0	2,000	6,000	331 5 7	170 0 0	501 5 7	4 14 7	Successful.
3	,, Dhulabhai Gumandas ...	Do. ...	Piplata ...	3	75 0							Unsuccessful.
4	,, Lalubhai Bhagatibhai ...	Do. ...	Uttarsanda ...	3	125 0							Do.
5	,, Shamlubhai Lallubhai ...	Mehmedabad ...	Aklaja ...	2½	58 0							Do.
6	,, Maganlal Laxmidas ...	Anand ...	Khambalaji ...	2½	62 0							Do.
7	,, Chagalal Jahidas ...	Mehmedabad ...	Vasva Murjiya	2½	215 0							Do.
8	,, Adam Abraham ...	Anand ...	Samarkha ...	3	27 0	250	1,250	108 4 8	28 0 0	136 4 8	5 0 7	Successful.
9	,, Alaudin Sherkha ...	Borsad ...	Pandola ...	3½	201 0	2,000	6,000	437 14 9	237 8 0	675 6 9	4 6 1	Do.
10	,, Motilal Dallabhai ...	Nadiad ...	Vadthal ...	3½	340 0	2,000	2,500	689 3 0	323 4 0	1,012 7 0	4 9 6	Do.
11	,, Babarbhai Haribhai ...	Borsad ...	Ashi ...	3	87 0	9,000	13,000	151 3 6	15 4 0	166 7 6	3 3 1	Do.
12	,, Vorha Adam Abraham...	Anand ...	Samarkha ...	3	130 0							Unsuccessful.
13	,, Nandaram Narbhiram ...	Borsad ...	Ashi ...	3	25 0	1,000	2,000	99 14 7	13 3 0	113 1 7	4 8 4	Successful.
14	,, Do.	Do. ...	Do. ...	3	52 0							Unsuccessful.
15	,, Alaudin Sherkha ...	Do. ...	Pandoli ...	3½	152 0	1,000	2,000	812 5 9	304 4 0	1,116 9 9	7 5 7	Successful.
16	,, Veribhai Vaghajibhai ...	Nadiad ...	Nadiad ...	3½	159 0							Unsuccessful.
17	,, Kalidas Lalubhai ...	Borsad ...	Ashi ...	3	53 0	1,000	5,000	183 2 8	36 2 6	219 5 2	4 2 1	Successful.
18	,, Rewabhai Jesanjibhai ...	Anand ...	Sadaspura ...	3	34 0	1,500	4,500	122 15 10	26 2 0	149 1 10	4 1 5	Do.
19	,, Hatimbhai Abdul Kadar	Kapadwanja ...	Kapadwanja ...	4	74 0		500	496 11 9	311 0 0	807 11 9	10 14 9	Do.
20	,, Mathabhai Kandas ...	Borsad ...	Ashi ...	3	42 0	6,000	9,000	159 11 6	50 10 0	210 5 6	4 15 3	Do.
21	,, Mathurbhai Lalubhai ...	Anand ...	Samarkha ...	3	36 0	1,000	4,000	37 10 11	51 0 0	88 10 11	2 7 7	Do.
22	,, Lalbeg Umbrobeg ...	Borsad ...	Pandoli ...	3½	105 0	1,000	2,000	560 15 9	176 10 0	737 9 9	7 0 5	Do.
23	,, Nathabhai Kandas ...	Do. ...	Ashi ...	3	91 0	9,000	14,000	288 9 1	65 12 0	354 5 1	3 14 3	Do.
24	,, Mathurbhai Shankarbhai	Anand ...	Samarkha ...	3	42 0	1,000	4,000	152 15 0	32 0 0	184 15 0	4 6 6	Do.
25	,, Nathubhai Kahandas ...	Borsad ...	Ashi ...	3	78 0	12,000	13,000	294 2 0	140 0 0	434 2 0	5 9 0	Do.
26	,, Raiji Mana ...	Anand ...	Samarkha ...	3	27 0	1,000	4,000	99 12 6	10 0 0	109 12 6	4 1 2	Do.
27	,, Ambalal Motibhai ...	Borsad ...	Pandoli ...	3	20 0	1,000	3,000	90 0 8	41 0 0	131 0 8	6 8 10	Do.
28	,, Somabhai Kalidas ...	Nadiad ...	Danda ...	3	40 0							Unsuccessful.
29	,, Gopalbhai Tulshibhai ...	Borsad ...	Pandoli ...	3	94 0	2,000	2,500	308 15 11	128 0 0	436 15 11	4 10 5	Successful.
30	,, Mahijibhai Jibhai ...	Anand ...	Napad ...	3	30 0	5,000	7,000	113 2 3	33 10 0	146 12 3	4 14 5	Do.
31	,, Somabhai Kalidas ...	Nadiad ...	Danda ...	3	41 0	2,000	4,000	184 9 3	187 2 0	371 11 3	9 1 2	Do.
32	,, Samalbhai Purshotamdas	Kapadwanja ...	Kapadwanja ...	4	54 0		500	282 0 5	135 15 0	417 15 5	7 11 10	Do.
33	,, Babarbhai Haribhai ...	Borsad ...	Ashi ...	3	36 0	15,000	19,000	130 8 9	33 8 0	169 1 3	4 8 11	Do.
34	,, Ashabhai Shankarbhai ...	Do. ...	Khanpur ...	3	79 8	250	6,250	209 11 3	60 6 0	360 1 3	4 4 3	Do.
35	,, Gopalbhai Tulsibhai ...	Do. ...	Pandoli ...	3	22 0							Unsuccessful.
36	,, Fulabhai Kishorbhai ...	Do. ...	Ras ...	3	113 0	1,000	5,000	363 13 4	100 8 0	464 5 4	4 1 8	Successful.
37	,, Govindbhai Ranchodbhai	Nadiad ...	Nadiad ...	3	58 0	1,000	2,000	196 8 9	150 0 0	346 8 9	5 15 9	Do.
38	,, Jiwanpuri Hardeshpuri	Anand ...	Navli ...	3	30 0	4,000	7,000	78 7 7	9 12 0	88 3 7	2 14 11	Do.
39	,, Taicbali Kadarali ...	Kapadwanja ...	Kapadwanja ...	4	70 0		250	405 10 7	196 4 0	511 14 7	8 9 7	Do.
40	,, Dulabhai Lallubhai ...	Borsad ...	Ras ...	3	117 0	1,000	7,000	390 10 3	116 8 0	507 2 3	4 5 4	Do.
41	,, Shankarbhai Lallubhai...	Anand ...	Samarkha ...	2½	24 0	1,000	4,000	66 4 0	10 0 0	76 4 0	3 2 8	Do.
42	,, Tribhuwan Uttamram ...	Borsad ...	Simglao ...	3	32 0	500	1,000	142 2 6	76 0 0	218 2 6	6 13 0	Do.
43	,, Sombhai Lallubhai, Manager Swami Narayan	Mehmedabad ...	Maryan ...	2½	56 0	1,000	2,000	145 3 6	50 0 0	195 3 6	3 7 6	Do.
44	,, Desarbhai Bholabhai ...	Nadiad ...	Narsinda ...	3	118 0	1,000	6,000	381 1 4	125 0 0	506 1 4	4 4 7	Do.
45	,, Jiwanpuri Haridaspuri...	Anand ...	Navali ...	3	40 0	7,000	10,000	147 15 8	59 0 0	206 15 8	5 2 10	Do.
46	,, Jethabhai Jeribhai ...	Do. ...	Samarkha ...	2½	52 0	1,000	4,000	135 12 6	40 0 0	175 12 6	3 6 2	Do.
47	,, Khanbhai Abdulali ...	Kapadwanja ...	Kapadwanja ...	4	80 0		250	413 6 1	189 6 0	602 12 1	7 8 7	Do.
48	,, Ambalal Motibhai ...	Borsad ...	Pandoli ...	3	49 0	1,000	6,000	194 12 5	168 0 0	362 12 5	5 8 6	Do.
49	,, Malbarkha Asatkha ...	Do. ...	Napa ...	2½	99 0	6,000	8,000	252 10 11	156 15 0	409 9 11	4 2 3	Do.
50	,, Punambhai Tulshibhai...	Nadiad ...	Uttarsanda ...	3	203 0							Unsuccessful.
51	,, Bhaiji Mathur ...	Anand ...	Samarkha ...	2½	60 0	500	1,500	70 6 3	118 0 0	188 6 3	3 2 2	Successful.
52	,, Muljibhai Laxmidas ...	Borsad ...	Jantraj ...	2½	72 0	1,500	2,500	182 6 8	66 8 0	248 14 0	3 7 4	Do.
53	,, Jiwanpuri Hardeshpuri	Anand ...	Navali ...	3	35 0							Unsuccessful.
54	,, Mosanbhai Hebtulabhai	Kapadwanja ...	Kapadwanja ...	4	78 0		250	432 1 8	264 8 0	696 9 8	8 15 0	Successful.

Serial No. of Bores.	Name of Well-owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring per hour in gallons.	Water after boring per hour in gallons.	Departmental charges.	Labour charges.	Total cost of bore-hole.	Cost per foot.	Result and Remarks
	Kaira District—contd.			Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
55	Mr. Bholabhai Jethabhai ...	Mehmedabad ...	Sankheja ...	2½	20 0	500	1,500	64 4 5	35 0 0	99 4 5	4 15 2	Successful.
56	„ Jiwanpuri Hardeshpuri..	Anand ...	Navali ...	3	80 0							Unsuccessful.
57	„ Pagigopal Jesang ...	Borsad ...	Jantral ...	2½	80 0	2,000	8,000	208 1 1	38 12 0	245 13 1	3 1 5	Successful.
58	„ Lallubhai Bhokarbhai ...	Do. ...	Danteli ...	2½	94 0	250	1,250	228 0 10	97 8 0	325 8 10	3 7 6	Do.
59	„ Rabari Tanga Mongha ...	Mehmedabad ...	Samadra ...	2½	49 0	500	1,500	146 2 0	76 12 0	222 14 0	4 8 10	Do.
60	„ Shamalbhai Mathurbhai	Anand ...	Samarkha ...	2½	53 0	1,500	3,500	164 9 6	33 2 0	172 11 6	3 4 3	Do.
61	„ Marghabhai Bakarbhai...	Borsad ...	Golal ...	2½	96 0	500	2,500	249 11 1	84 11 0	334 6 1	3 7 8	Do.
62	„ Himatsing Dallubhai ...	Do. ...	Danteli ...	2½	102 0	1,000	7,000	276 4 8	176 0 0	452 4 8	4 6 11	Do.
63	„ Chhotalal Dwarkadas ...	Mehmedabad ...	Samatra ...	2½	86 0							Incomplete.
64	„ Mathurbhai Kakoji ...	Anand ...	Samarkha ...	2½	22 0	250	3,250	81 4 1	58 0 0	139 4 1	6 5 1	Successful.
65	„ Hardeshpuri Desapuri...	Do. ...	Navali ...	3	30 0	4,000	9,000	111 5 2	48 0 0	159 5 2	5 4 10	Do.
	Panchamahal District.											
66	Mr. Ambalal Narayanbhai ...	Matar ...	Medala ...	2½	47 0	1,000	3,000	130 15 0	[illegible]8 0	163 7 0	3 7 6	Do.
67	„ Ichhabhai Bapuji ...	Anand ...	Samarkha ...	2½	54 0							Incomplete.
68	„ Dayabhai Tulsibhai ...	Borsad ...	Golal ...	3	52 0	2,000	8,000	191 4 0	60 6 0	251 10 0	4 13 6	Successful.
69	„ Antha Bhaiji ...	Godhra ...	Shimpuri ...	4	50 0	250	1,000	28 12 0	98 0 0	126 12 0	2 8 7	Do.
70	„ Lalubhai Vasandas ...	Do. ...	Do. ...	4	6 0							Unsuccessful.
71	Do.	Do. ...	Do. ...	4	6 6							Do.
72	„ Haji Isa Haji Sadba ...	Do. ...	Sanklija ...	4	30 0	1,000	2,000	97 4 4	154 14 0	252 2 4	8 6 5	Successful.
73	„ Thakursahib ...	Halol ...	Bhamarja ...									Incomplete.
	Ahmedabad District.											
74	Mr. Maneklal Manilal ...	Dasakari ...	Manipur ...	3½	198 0		1,000	542 2 10	753 12 0	1,295 14 10	8 10 3	Successful.
75	„ Kalidas Lalubhai ...	Ahmedabad ...	Ahmedabad ...	3½	260 0	4,000	10,000	372 14 5	114 12 0	487 10 5	4 11 10	Do.
76	Local Board ...	Dholka ...	Transad ...	3	106 0	1,000	5,000	276 15 0	232 10 0	509 9 0	6 10 0	Do.
77	Do. ...	Do. ...	Rampur ...	3	238 0							Unsuccessful.
78	Kaiser-i-hind Mills ...	Ahmedabad ...	Ahmedabad ...	3½	66 0	1,000	3,000	369 11 3	94 0 0	463 11 3	7 0 6	Successful.
79	Mr. Manilal Maganlal ...	S. Daskheri ...	Manipur ...	3	67 0		250	287 9 5	82 3 0	369 12 5	5 8 4	Do.
80	„ Ambalal Narayandas ...	Do. ...	Madalpur ...	3	143 0							Unsuccessful.
81	„ Jiwabhai Chhotalal ...	Do. ...	Manipur ...	3	70 0		250	237 8 8	128 4 0	365 12 8	5 3 8	Successful.
82	Local Board Well ...	Dholka ...	Nesada ...	3	108 0							Unsuccessful.
83	Mr. Maganlal Bhaichand ...	Dasakoshi ...	Manipur ...	3	81 0	1,000	3,000	308 10 7	253 8 0	562 2 7	6 15 0	Successful.
84	„ Masurihaji Hasambhai Mohmedbhai.	Ahmedabad ...	Ahmedabad ...	3	50 0		250	177 1 9	85 4 0	262 5 9	5 3 10	Do.
85	Local Board Well ...	Dholka ...	Paldi ...	3	46 0							Unsuccessful.
86	Mr. Hoshangaji Barjorji ...	Dasakeri ...	Watwa ...	3	36 0							Incomplete.
87	„ Ambalal H. ...	Do. ...	Rajapur Hirpur	3	54 0		250	201 11 6	56 4 0	257 15 6	4 12 5	Successful.
88	„ Maneklal Manilal Ranchhodadas.	Do. ...	Manipur ...	3	59 0		500	231 13 3	158 0 0	389 13 3	6 7 1	Do.
	Broach District.											
89	Mr. Dudsham Pirojasham ...	Ankleshwar ...	Ankleshwar ...	4	205 0							Unsuccessful.
90	„ Narotam Purshotam ...	Do. ...	Do. ...	3½	25 0	500	2,500	86 12 5	38 0 0	124 12 5	5 0 0	Successful.
91	Do.	Do. ...	Do. ...	3½	26 0	500	2,500	123 5 10	34 0 0	157 5 10	6 0 8	Do.
92	„ Gopalbhai Bhupabhai ...	Amod ...	Samani ...	3	46 0	2,000	2,500	236 5 6	40 0 0	276 5 6	6 0 0	Do.
93	„ Mulji Lallubhai ...	Ankleshwar ...	Ankleshwar ...	3½	60 0	1,000	4,000	367 12 3	90 12 0	457 12 3	7 10 5	Do.
94	„ Vallabhbhai Narsibhai ...	Do. ...	Do. ...	3½	104 0	225	1,225	489 7 3	113 12 0	603 3 3	5 12 9	Do.
95	Mrs. Bai Manchha, widow of Nagji Jaga.	Do. ...	Do. ...	3½	32 0	250	2,250	174 15 6	48 6 0	223 5 6	6 15 6	Do.
96	Mr. Ishwarbhai Bhawadas ...	Amod ...	Kilod ...	3	50 0		500	183 10 6	30 0 0	213 10 6	4 4 6	Do.
97	„ Bakarbhai Narayanbhai	Vaghari ...	Saran ...	3	75 0		500	315 2 10	75 0 0	390 2 10	5 3 2	Do.
98	„ Maghajibhai Phakirbhai	Ankleshwar ...	Ankleshwar ...	3½	24 0	500	1,500	122 2 10	28 0 0	150 2 10	6 4 0	Do.
99	„ Chhotalal Gulabbhai ...	Do. ...	Do. ...	3½	31 0							Unsuccessful.
100	„ Narayandas Khushaldas	Do. ...	Do. ...	3½	27 0	250	1,250	156 4 0	55 6 0	211 10 0	7 13 7	Successful.
101	Do.	Do. ...	Do. ...	3½	22 0	1,250	2,250	130 11 2	32 10 0	163 5 2	7 6 7	Do.
102	„ Lala Kuber ...	Do. ...	Diwa ...	3½	60 0							Unsuccessful.
	Surat District.											
103	Mr. K. K. Desai ...	Balsad ...	Balsad ...	3½	54 0		250	142 10 6	110 0 0	252 10 6	2 15 6	Successful.
104	„ Fakirji Ismailji ...	Do. ...	Do. ...	3	44 0		450	90 2 6	45 0 0	135 2 6	1 12 0	Do.
105	„ Morarji J. Desai ...	Amalsad ...	Kacholi ...	4	78 0							Incomplete.

Serial No. of Bores.	Name of Well-owner.	Name of Taluka.	Name of village.	Diameter of Bore.	Depth of Boring.	Water before boring per hour gallons.	Water after boring per hour gallons.	Departmental charges.	Labour charges.	Total cost of bore-hole.	Cost per foot.	Result and Remark.
	East Khandesh District.			Inches.	Ft. in			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs a. p.	
106	Mr. Dhondi Mahadu Shimpi.	Pachora ...	Nager Dewla ...	3	93 0							Abandoned at well-owner's request.
107	,, Gangaram Vedushet Vani.	Do. ...	Do. ...	3	34 0							Do.
108	,, Bhika Lakadushet ...	Do. ...	Dighi ...	3	44 0							Do.
109	Villagers of Betawad ...	Jamner ...	Betawad ...	3								Incomplete.
	Nasik District.											
110	Mr. Ishatera Mohmed ...	Malegaon ...	Malegaon ...	3	101 0		1,000	104 8 6	150 7 6	255 0 0	2 8 0	Successful.
111	Mr. Narayan Zuma Kasushet Vani.	Do. ...	Do. ...	3	21 0	200	5,000	27 1 8	48 0 0	75 1 8	3 9 0	Do.
112	,, Bhila Sakharam Teli ...	Do. ...	Do. ...	3	46 0	600	900	31 15 0	87 8 0	119 7 0	2 9 0	Do.
113	,, Gabaji Teli ...	Do. ...	Do. ...	3	31 0							Abandoned at owner's request.
114	,, Shankar S. Tipare ...	Malegaon ...										Incomplete.
	Thana District.											
115	Mr. S. S. Barve ...	Dahanu ...	Tarapur ...									Incomplete.
116	,, Raoji Gopal Dandekar...	Mahim ...	Palghar ...									Do.
117	,, Framji Rustomji ...	Dahanu ...	Nargol ...									Do.
118	,, Dorabji Sorabji ...	Do. ...	Wangaon ...									Do.
119	Sub-Divisional Officer ...	Mahim ...	Palghar ...	6	101 0		900	301 10 6	75 0 0	376 10 6	3 11 0	Successful.
120	Mr. Manekji Hormasji ...	Umbergaon ...	Asad ...	3	96 0	1,000	1,500	57 10 0	85 8 0	143 2 0	1 8 0	Do.
121	,, Amirsaheb Mohodin Race.	Dahanu ...	Manor ...	3	60 0		1,000	95 4 0	36 0 0	131 4 0	2 3 0	Do.
122	,, Narayan Keshav Patil...	Mahim ...	Palghar ...	6	88 0		3,000	117 8 0	59 0 0	176 8 0	2 0 0	Do.
123	Dr. Masania ...	Dahanu ...	Gholwad ...	3	21 0	800	1,600	18 11 6	16 9 0	35 3 6	1 10 0	Do.
124	Do. ...	Do. ...	Do. ...	3	30 0		800	34 1 6	27 8 0	61 9 6	1 9 0	Do.
125	Mr. Nathubhai ...	Do. ...	Do. ...	3	57 0	1,500	2,500	25 13 6	44 12 0	70 9 6	1 4 0	Do.
126	,, Jamiatlal Pranjiwandas.	Salsettee ...	Malad ...	3	100 0	1,000	1,800	76 15 4	288 0 0	364 15 4	3 10 0	Do.
127	,, Nathubhai ...	Dahanu ...	Gholwad ...	3	44 0	2,500	3,000	36 10 0	40 0 0	76 10 0	1 12 0	Do.
128	,, Sorabji Irani ...	Do. ...	Do. ...	3	32 0		800	57 1 0	32 0 0	89 1 0	2 12 0	Do.
129	,, Fardumshet Irani ...	Do. ...	Do. ...	3	38 0	300	1,500	21 10 0	25 0 0	46 10 0	1 3 0	Do.
130	,, Gopal Nana Patil ...	Do. ...	Bordi ...	3	45 0	100	2,000	24 5 6	21 0 0	45 5 6	1 0 0	Do.
131	,, K. K. Dandekar ...	Mahim ...	Palghar ...	6	96 0		1,000	193 7 5	22 9 0	216 0 5	2 4 0	Do.
132	Govt. Agricultural School ...	Kalyan ...	Jambul ...	3	68 0		300	64 11 3	219 0 0	283 11 3	4 0 0	Do.
133	Mr. Gopal Nana Patil ...	Dahanu ...	Bordi ...	3	56 0		800	19 13 0	23 0 0	42 13 0	0 12 0	Do.
134	Do. ...	Do. ...	Do. ...	3	54 0	1,000	2,000	19 12 0	28 0 0	47 12 0	0 14 0	Do.
135	Do. ...	Do. ...	Do. ...	3	54 0	800	1,200	18 4 0	18 0 0	36 4 0	0 11 0	Do.
136	Mr. Dama Gopala ...	Do. ...	Do. ...	3	21 0	100	1,000	17 13 6	27 8 0	45 5 6	2 2 0	Do.
137	Do. ...	Do. ...	Do. ...	3	22 0	1,000	1,500	21 9 0	22 0 0	43 9 0	2 0 0	Do.
138	Mr. Hira Laxman Raut ...	Do. ...	Do. ...	3	29 0	200	800	13 3 6	10 0 0	23 2 6	0 12 9	Do.
139	,, Narayan Laxman Raut...	Do. ...	Do. ...	3	27 0		800	38 4 6	27 8 0	65 12 0	2 7 0	Do.
140	,, Kalu Jiwan ...	Do. ...	Do. ...	3	42 0	100	900	14 4 8	27 8 0	41 12 8	0 15 11	Do.
141	,, Raghunath S. Mule ...	Do. ...	Chukala ...	3	65 0							Incomplete.
142	,, Amirsaheb Race ...	Do. ...	Manor ...	3	40 0							Do.
143	,, Tarabadkar ...	Salsettee ...	Malad ...	3	65 0		1,000	68 8 6	43 12 0	110 4	1 11 2	Successful.
144	,, Chhotalal Ramdas ...	K. Mahim ...	Palghar ...	6	11 0							Incomplete.
145	,, Pestonji Byramji ...	Salsettee ...	Malad ...	3	35 8							Abandoned at owner's request.
146	,, Khudadas Irani ...	Dahanu ...	Malyal ...	3	55 0	50	1,000	29 15 6	61 11 0	91 10 0	1 10 8	Successful.
147	Do. ...	Do. ...	Do. ...	3	76 0		600	25 3 0	51 3 0	76 6 0	1 0 1	Do.
148	,, Anandrao Joshi ...		Kelwa ...	3	27 0							Incomplete.
149	,, M. T. Pendse ...	Dahanu ...	Gholwad ...	3	35 0	100	500	40 3 6	43 8 0	81 11 6	2 6 3	Successful.
150	,, Vithal Pateel ...	Do. ...	Do. ...	3	25 0							Incomplete.
151	,, Tamuhe, Pleader ...	Thana ...	Bhiwandi ...	3	18 6							Do.
152	,, Pestonji Byramji ...	Salsettee ...	Malad ...	3	32 3							Do.
	Kolaba District.											
153	Mr. Amin Bhaiji ..	Alibag ...	Jaskar ...	4	212 0							Unsuccessful.
154	,, B. M. Tilak ...	Pen ...	Wawashi ...	3	46 0							Incomplete.
155	,, Ramkrishna Balabhai ..	Alibag. ...	Uran ...	3	50 0		800	10 15 0	31 4 0	42 3 0	0 13 3	Successful.
156	Govt. Agricultural Farm ...	Do. ...	Bandhan ...	3	100 0		300	80 14 8	180 0 0	260 14 8	2 9 4	Do.

Serial No. of Bores.	Name of Well-owner.	Name of Taluka.	Name of village.	Diameter of Bore.	Depth of Boring.	Water before boring per hour gallons.	Water after boring per hour gallons.	Departmental charges.	Labour charges.	Total cost of bore-hole.	Cost per foot.	Result and Remarks.
	Kolaba District—contd.			Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
157	Mr. B. M. Hodiwala ...	Alibag ...	Mora ...	5	139 0							Incomplete.
158	Govt. Farm, Alibag ...	Do. ...	Alibag ...	3	17 6							Do.
	Poona District.											
159	Mr. Anaji Dhondu Patil ...	Junner ...	Junner ...	4	100 0		1,000	43 8 0	156 8 0	200 0 0	2 0 0	Successful.
160	Do. ...	Do. ...	Do. ...	4	49 0		1,000	20 8 6	77 7 6	98 0 0	2 0 0	Do.
161	Anath Vidyarthi Griha ...	Haveli ...	Chinchawad ...	5	102 0		1,200	71 1 10		71 1 10	0 11 0	Do.
	Satara District.											
162	Mr. K. G. Bhat ...	Wai ...	Wai ...	3	34 0							Unsuccessful.
163	Islampur Municipality ...	Walwa ...	Islampur ...	3	78 6							Do.
164	Mr. Annasaheb Mantri ...	Do. ...	Do. ...	3	169 6	1,000	5,000	89 9 8	380 0 3	469 9 11	2 2 11	Successful.
165	Do. ...	Do. ...	Do. ...	3	52 0	5,000	5,500	29 0 9	94 8 0	123 8 9	1 4 5	Do.
166	Do. ...	Do. ...	Do. ...	3	7 0							Abandoned at owner's request.
167	Islampur Municipality ...	Do. ...	Do. ...	3	7 0							Incomplete.
	Sholapur District.											
168	Mr. G. B. Bhingarkar ...	Madha ...	Kurduwadi ...	3	64 0		500	100 6 11	37 8 0	137 14 11	2 2 6	Successful.
169	„ Gulabchand Khemraj ...	Do. ...	Do. ...	3	28 0	250	1,000	16 8 5	60 0 0	76 8 5	1 2 0	Do.
170	Do. ...	Do. ...	Do. ...	3	44 0	1,000	2,000	17 14 7	78 8 0	96 6 7	1 4 10	Do.
171	Do.	Do. ...	Do. ...	3	66 0		250	61 6 7	60 8 0	121 14 7	1 13 7	Do.
172	„ V. J. Dikole ...	Do. ...	Do. ...	3	63 0		250	58 15 6	40 0 0	98 15 6	1 9 1	Do.
173	„ M. N. Pardeshi ...	Do. ...	Do. ...	3	73 0		250	76 12 6	45 0 0	121 12 6	1 10 8	Do.
174	Do. ...	Do. ...	Do. ...	3	50 0		250	23 10 7	38 2 0	61 12 7	1 3 9	Do.
175	„ D. B. Khatriya ...	Karmala ...	Kondeja ...									Incomplete.
	Bijapur District.											
176	Taluka Local Board, Bagalkot	Bagalkot ...	Tulsigiri ...	3	75 0		280	146 9 1	174 14 0	321 7 1	4 4 7	Successful.
177	C. W. of Kajidoni ...	Do. ...	Kajidoni ...	3	120 0							Incomplete.
	Belgaum District.											
178	C. W. of Laxmeshwar ...	Gokak ...	Laxmeshwar ...	4	151 8							Unsuccessful.
179	C. W. of Kulgod ...	Do. ...	Kulgod ...	4	97 6							Incomplete.
	Dharwar District.											
180	T. L. B., Ranebennur ...	Ranebennur ...	Byadagi ...	3	29 5							Abandoned at owner's request.
181	Mr. L. G. Sawkar ...	Do. ...	Hentrwali ...	3	60 0		250	90 13 9	65 15 0	156 12 9	2 9 10	Successful.
182	Do. ...	Do. ...	Do. ...	3	62 0							Mishap of tool.
183	„ R. H. Sawakar ...	Do. ...	Maidur ...	3	45 0		250	16 12 3	125 0 0	141 12 3	3 2 5	Successful.
184	„ R. B. Sawakar ...	Do. ...	Do. ...	3	49 8		250	13 4 0	120 0 0	133 4 0	2 10 11	Do.
185	Mrs. Venkamma Sawakar ...	Do. ...	Do. ...	3	40 0		250	53 10 5	116 8 0	170 2 5	4 4 1	Do.
186	Mr. R. H. Sawkar ...	Do. ...	Do. ...	3	34 0							Unsuccessful.
187	„ Timappa Desappa ...	Do. ...	Do. ...	3	23 0							Abandoned at owner's request.
188	Vice-President, Gadapur Municipality.	Do. ...	Dewargad ...	3								Incomplete.
	Kanara District.											
189	Rao Bahadur B. M. Basrur.	Honawar ...	Honawar ...	3	106 4	350	750	275 2 0	48 13 0	723 15 0	6 3 4	Successful.
190	Mr. Govindrai Shetti ...	Do. ...	Do. ...	3								Abandoned at owner's request.
191	Do. ...	Do. ...	Do. ...	3	73 0							Incomplete.
	Ratnagiri District.											
192	Mr. V. A. Desai ...	Ratnagiri ...	Ratnagiri ...	3	95 0		250	13 13 4	32 0 0	45 13 4	0 7 9	Successful.
193	Do. ...	Do. ...	Do. ...	3	8 4							Unsuccessful.
194	Mr. Ranade ...	Do. ...	Do. ...	3	91 0							Do.
195	Govt. Farm ...	Hatkhamba ...	Hatkhamba ...	3	45 0							Incomplete.
	Mirpurkhas District (Sind).											
196	Agricultural Seed Farm ...	Mirpurkhas ...	Mirpurkhas ...	4	73 0							Abandoned owing to mishap of tool.
197	Do. ...	Do. ...	Do. ...	4	100 0							Incomplete.

W. M. SCHUTTE,
Agricultural Engineer, B. P.,
Poona.

STATEMENT II.

Abstract showing particulars of each Division in the whole of the Presidency.

No.	Item.	N. D.	C. D.	S. D.	Sindh.	Total:
1	Bores made ...	102	59	34	2	197
2	Do. successful ...	75	36	16		127
3	Do. unsuccessful	12	1	6	1	20
4	Do. incomplete or on hand.	4	17	7	1	29
5	Do. abandoned at well-owner's request.	11	5	5		21
6	Total depth bored in feet	5,630	3,436	2,220	185	11,471
7	Do. Cost of successful bores.	24,739-10-3	4,513-4-10	2,562-13-7		32,052-9-8
8	Percentage of success.	86·1	97·4	73·0		
9	Average number of working days for each bore.	17·39	13·74	13·7	27	
10	No. of accidents met with.	11	16	7	2	36
11	Do do. removed.	8	15	6	2	31
12	Average number of feet bored in one day.	3 3″	4′ 5″	5′	2′ 9″	

N.B—N. D. includes Ahmedabad, Kaira, Panch Mahals and Broach Districts.

C. D. includes Surat, Thana, Kolaba, Nasik, East and West Khandesh, Nagar and Poona Districts.

S. D. includes Satara, Sholapur, Belgaum, Bijapur, Dharwar, Ratnagiri and N. Kanara Districts.

W. M. SCHUTTE,
Agricultural Engineer, B. P.,
Poona.

STATEMENT III.

Statement showing the Results of Tests of Motor Tractors and Ploughs.

Serial No.	Name of Tractor and Plough.	Description.	Cost of Tractor and Plough	No. of Bottoms.	Width of Plough.	Average depth of ploughing in inches.	Gross time required for ploughing one acre.	Approximate time required for turning.	Kerosine required for one acre.	Petrol required for one acre.	Lubricating oil required for one acre.	Sundry charges.	Driving charges for one acre including driver, oilman, &c.	Total charges for ploughing one acre excluding interest, depreciation, &c.	Total charges for ploughing one acre including interest, depreciation, &c.	Speed in miles per hour.	Remarks.
							H. m.	H. m.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
1	Case ...	Four cylinder vertical motor	7,250	3	3′	6″ to 7″	2 30	0 24	28	½	1½	0 8 3	0 13 4	5 7 7	8 4 9	1 Mile.	From trials taken at Dharwar and Hotgi.
2	Fordson.	Do. ...	4,350	2	28″	5″ to 6″	3 0	0 20	48	1	2	0 6 5	0 13 4	8 1 9	9 12 11	2 Miles.	
3	Mogal...	Single cylinder horizontal Engine.	8,000	2	28″	6″ to 7″	3 0	0 20	36	½	1½	0 11 11	0 13 4	6 9 3	10 11 1		
1	Case ...	Four cylinder vertical motor	7,250	3	3′	8″	2 0	0 24	32	½	1½	0 8 3	0 13 4	5 12 7	8 9 9		From trials taken at Charodi.
2	Fordson.	Do. ...	4,350	2	28″	4½″	2 15	0 20	32	1	2	0 6 5	0 13 4	6 5 9	8 0 11		

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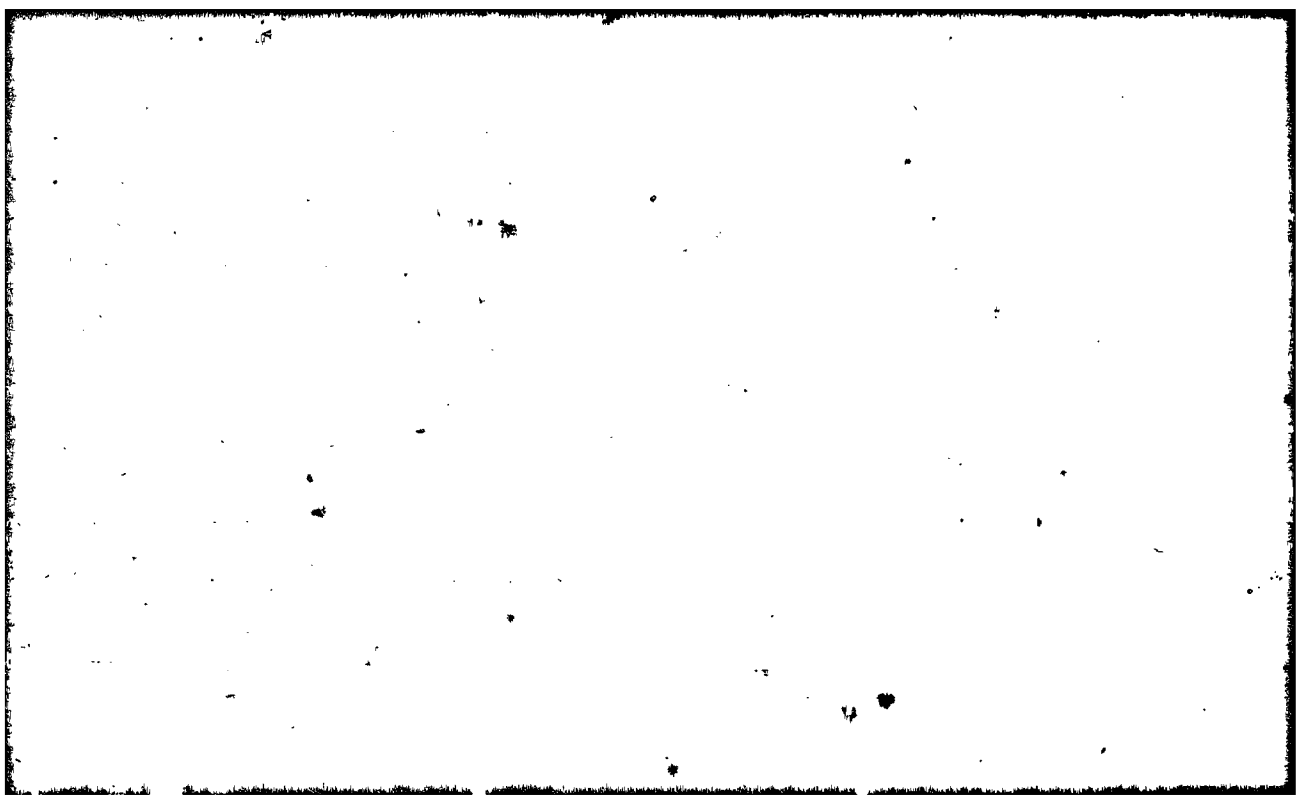
Correction Slip to be pasted in the Annual Report of the Department of Agriculture, Bombay Presidency, for 1919-20.

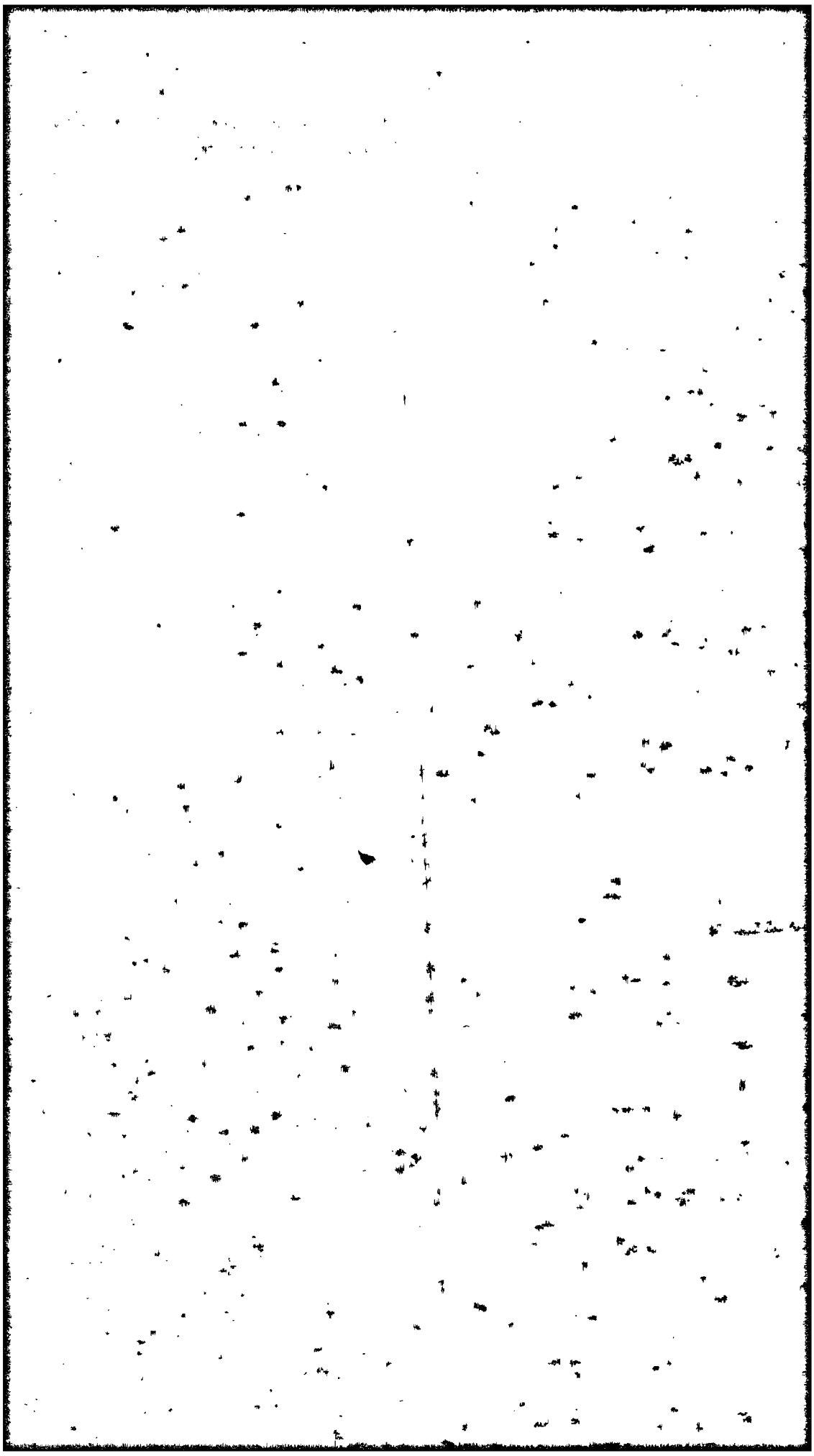
Para.	Page.	*For*	*Read*
7 Para.	3	Kumpta.	Kumta.
In the statement below sub-para.	12	127 and 139.	137 and 170.
In the Comparative Statement of Drill *vs.* Plough Method of Sowing Maiz.	36	1006	1086



LIST OF AGRICULTURAL BULLETINS PUBLISHED BY THE DEPARTMENT OF AGRICULTURE (1908 TO 1918-19) AND KEPT FOR SALE AT THE GOVERNMENT BOOK DEPOT, BOMBAY, POONA.

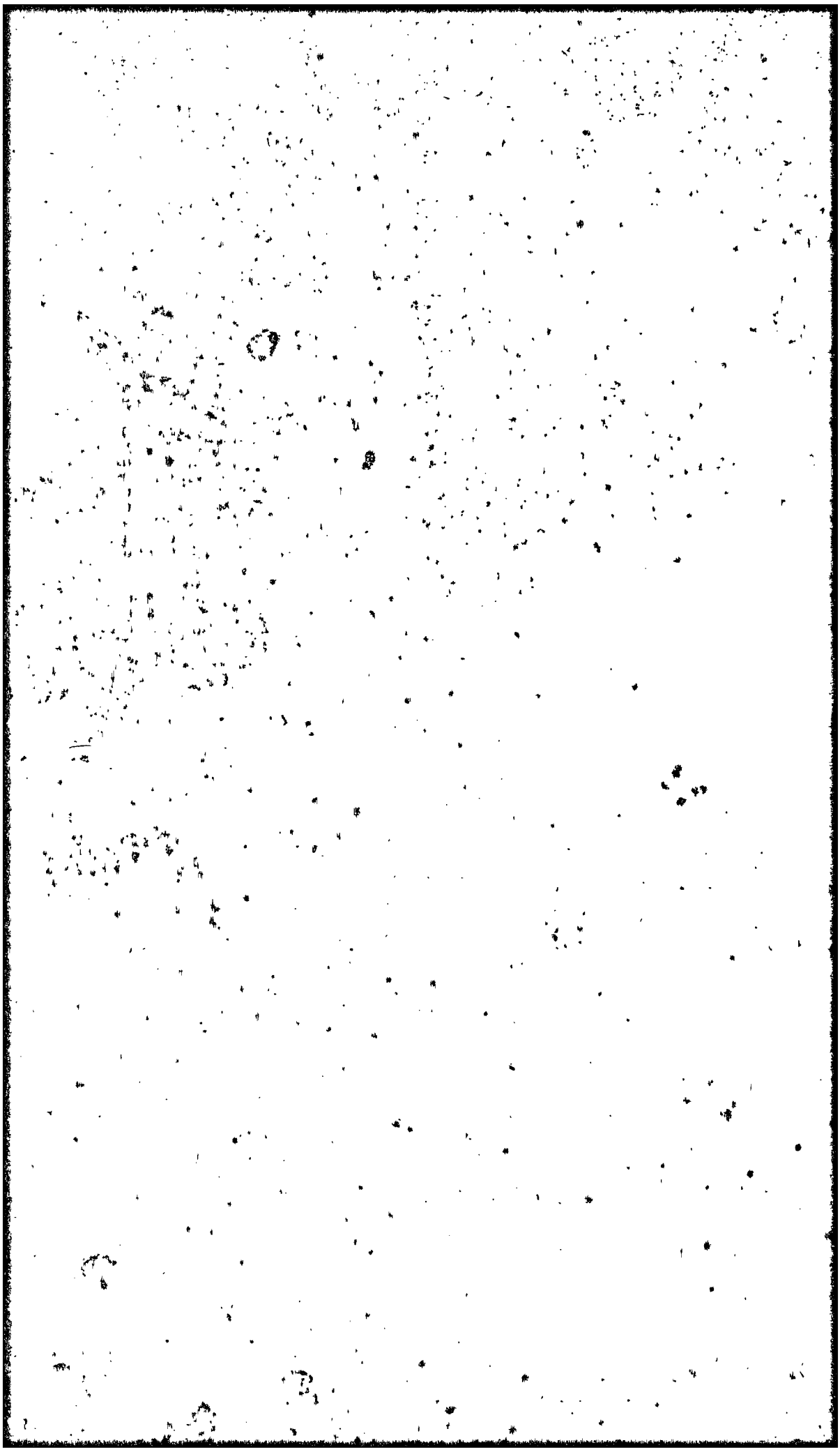
No.	Year.	*Subject.*	Price. Rs.	a.	p.
30	1908	Field, Garden and Orchard Crops of the Bombay Presidency, by G. A. Gammie, Economic Botanist, Bombay ...	0	12	0
32	1908	Locusts in India, by H. M. Lefroy, Imperial Entomologist, Pusa	0	8	0
33	1909	Cultivation of Broach Cotton in Dharwar, by M. L. Kulkarni, Divisional Inspector of Agriculture, S.D. ...	0	4	0
,,	,,	,, ,, (Kanarese) ...	0	4	0
34	1909	Night-soil—A Valuable Manure, by G. K. Kelkar, Assistant Professor of Agriculture, Agricultural College, Poona ...	0	4	0
35	1909	Kalar in Sind, by G. S. Henderson, Deputy Director of Agriculture, Sind ...	0	4	0
36	1910	First Experiments in the Treatment of Grape-Vine Mildew in the Bombay Presidency, by W. Burns, Economic Botanist ...	0	14	0
37	1910	An Examination of the Seed-Supply of the Broach District, by G. D. Mehta.	0	4	0
39	1910	The Salt Land of the Nira Valley, by Harold H. Mann, Principal, Agricultural College, Poona, and V. A. Tamhane, Laboratory Assistant, Agricultural College, Poona ...	0	5	0
40	1911	The Cultivation of Guavas near Poona, Dharwar and Limbgaon ...	0	12	0
41	1911	Groundnuts in the Bombay Deccan ...	0	4	0
42	1911	Note on Long-stapled Cotton in Sind ...	0	3	0
43	1911	An Examination of the Seed-Supply of the Broach District, Part II ...	0	5	0
44	1911	Preliminary Study of the Red Rot of Sugarcane in the Bombay Presidency.	0	8	0
45	1911	Second Year's Experiments in the Treatment of Grape-Vine Mildew in the Bombay Presidency ...	0	14	0
46	1911	Seed Selection Series I, Broach Cotton ...	0	8	0
47	1911	San Hemp ...	0	4	0
48	1911	Poona Furnace ...	0	7	0
,,	,,	,, ,, (Marathi) ...	0	6	0
49	1911	An Examination of the Seed-Supply of the Ahmednagar District, Part I.	0	5	0
50	1912	An Examination of the Seed-Supply of the Ahmednagar District, Part II.	0	3	0
51	1912	Third Year's Experiments in the Treatment of Grape-Vine Mildew ...	0	3	0
52	1912	Muscovado Sugar Machinery and its scope for *Gul* Manufacture in India.	0	8	0
53	1912	A Method of improving the Quality of Cotton Seed ...	0	7	0
54	1912	A Note on Steam Ploughing ...	0	10	0
55	1913	An Examination of the Seed-Supply of the Poona District ...	0	3	0
56	1913	Present State of the Dairying Industry in Bombay ...	0	3	0
57	1913	Improvement of the Indigenous Plough of Western India ...	0	12	0
58	1913	Prickly-Pear Experiments ...	0	14	0
59	1914	Common Salt and its use as Manure in the Konkan Division ...	0	3	0
60	1914	Note on Indian Sugar Industry and Modern Methods of Sugar Manufacture ...	0	12	0
61	1914	Sugarcane, its Cultivation and Gul Manufacture ...	0	5	0
62	1914	The Value of Castration of Deccan Bullocks ...	0	3	0
63	1914	Substitutes for Rab ...	0	3	0
64	1914	Alkali or Kalar Experiments and Completion Report of Daulatpur Reclamation Station in Sind ...	0	14	0
65	1914	A list of diseases of Economic Plants occurring in the Bombay Presidency..	0	4	0
66	1914	Indigenous Implements of the Bombay Presidency ...	2	2	0
67	1914	An Examination of the Seed-Supply of the Sholapur District ...	0	3	0
68	1914	A Note on Well Boring ...	0	5	6
69	1915	The Rice Stem Borer in the Konkan ...	0	3	6
70	1915	Improvement of Cotton in the Bombay Presidency (except Sind) ...	0	3	6
71	1915	The Grape Growing in the Nasik District ...	0	9	0
72	1915	Experiments with the Automatic Water-Finder in the Trap Region of Western India ...	0	4	0
73	1915	Hand List of Plants, Seeds and Bulbs available for distribution in the Ganeshkhind Botanical Gardens, Kirkee ...	0	2	6
74	1915	Well Water from the Trap Area of Western India ...	0	6	0
75	1915	Note on Cattle of the Bombay Presidency ...	0	3	0
76	1915	Artificial Manures-Experiments on their value for crops in Western India...	0	4	0
77	1916	Fodder Crops of Western India ...	0	11	3
78	1916	Some wild fodder plants of the Bombay Presidency ...	0	13	0
79	1916	The Cultivation of Guavas in Gujarat ...	0	5	6
80	1916	List of Seeds available on the Agricultural College Farm, Poona ...	0	5	3
81	1916	Note on Fencing Construction ...	0	6	9
82	1916	Cultivation of drilled paddy in South Bombay Presidency ...	0	9	0
83	1917	The Spice Gardens of Sirsi in Kanara ...	0	10	6
84	1917	Seed Selection Series—Kumpta Cotton ...	0	1	0
85	1917	Note on Cattle in the Bombay Presidency ...	0	11	0
86	1917	Establishment and Management of the Dairy Farm ...	0	7	0
87	1918	The Utilisation of Inferior Grass Herbage, Experiments at the Tegur Cattle Farm ...	0	9	0
88	1918	First Report on Fruit culture as practised round about Tharushah (Sind) in Nawabshah District ...	0	2	0
89	1918	Artificial Manures: Experiments on their value for crops in Western India ...	0	3	3
90	1918	Work on the Manjri Farm for the years 1915-18 ...	0	7	3
91	1919	The Cultivation of Berseem in Sind—Experiments at Sukkur ...	0	1	0
92*	1919	Classification and Description of the Jowars of the Bombay Karnatak ...	0	10	3
93*	1919	Palm Gul Manufacture in the Bombay Presidency (Principally Date Palm) ...	1	3	9
94	1919	The Sugarcane Borer and its Control ...	0	4	3
95	1919	The Cultivation of Oranges and Allied Fruits in the Bombay Presidency...	0	2	6
96	1920	Investigations into the manure of the salt lands of Sind ...	0	12	0
97	1920	Prickly-pear as a Cattle Food ...	1	4	0
98	1920	Fruit Culture as practised near Shikarpur, Sind ...	0	1	6
99*	1920	The Rice Cultivation in the Larkhana District, Sind ...			
100*	1920	Fodder Crops of Western India ...			
101	1920	Fruit Culture in Palitana and Jamnagar ...			
102*	1920	Investigations of Potato Cultivation in Western India ...			
103*	1920	The Book of the Mango ...			
104*	1920	The Ganeshkhind Botanical Garden, Kirkee (Its Genesis and Development).			
105*	1920	The Groundnut Bug and its Control ...			
106*	1920	Dharwar American Cotton (Its History Cultivation and Improvement) ...			

*In the Press.



CONTENTS.

	Paragraph.	Page.
Introductory ...	1-2	1
CHAPTER I.—Research and Investigation.		
Cotton Investigation ...	3—4	1—2
Sugarcane do. ...	5	2
Potato do. ...	6	2
Rice do. ...	7	3
Grass do. ...	8	3
Fodder do. ...	9	3
Wheat do. ...	10	3
Bajri do. ...	11	3
Fruit do. ...	12	4
Cardamom do. ...	13	4
Other Investigations on Crops and Plants ...	14	4
Cattle Investigations ...	15	4
Soil do. ...	16	4—5
Agricultural Engineering Investigations ...	17	5
CHAPTER II.—Demonstration and Propaganda.		
Definite purpose of the Agricultural Department should be increased in quantity or improvement in the quality of Agricultural produce. The work of the Department will be seen in the introduction of iron ploughs, foreign groundnut, new selected types of cotton, revival of grape industry of Nasik, improvements in sugarcane and potato cultivation, ridge system of cultivation of cotton and jowar, &c.	18—20	5—6
Division of charges into six each under a Deputy Director for Propaganda Work.	21	6
Popularity of improved cotton in Gujarat and particularly in the Broach and Panch Mahals District.	22	6
Distribution on an extensive scale of improved types of Kumta and Dharwar American cottons in Southern Division.	23	6
Accounts by the various Deputy Directors of the Propaganda Work.	24	6
Agricultural Associations, Co-operative Unions and the three Vernacular Agricultural Magazines conducted by the different associations.	25	6—7
Bulletins and Leaflets ...	26	7
Efforts for popularising demonstration and propaganda work of the Agricultural Department.	27	7
CHAPTER III.—Services undertaken for the Public.		
Services undertaken for the Public ...	28	7
Seed Supply ...	29	8
Implement Depots ...	30	8
Water Finding and Boring ...	31	8
Steam Ploughing ...	32	9
Fodder Storage ...	33	9
Supply of Premium Bulls ...	34	9
Famine Cattle Camps ...	35	9
CHAPTER IV.—Agricultural Education.		
Agricultural College and its increasing popularity ...	36—37	9—10
Agricultural Schools and their useful work ...	38	10
CHAPTER V.—Administration and Finance.		
Changes in the personnel due to leave ...	39—40	11
Expenditure, Receipts ...	41—43	11



Correction Slip

To The Annual Report of the Department of Agriculture, Bombay Presidency, for the year 1920-21.

Page.	Reference.	For	Read
Contents.	Chapter II, Line 2nd ...	Increased.	Increase.
11	Line 1st, Mr. N. M. Chibber ...	N.	H.
13	Para. 6—The special crop optionals—		
	(6) Narcotics		1
	(7) Fruits ...		1
15	Statement showing localities from which our Students are drawn—		
	Central India; in Column "1919" ...		1
	United Provinces; in Column "1921" ...		1
	Berar " " "1915" ...		1
	" " " "1916" ...		1
	" " " "1917" ...		1
	" " " "1919" ...		1
	" " " "1920" ...		1
	Total " " "1915" ...	124	125
	" " " "1916" ...	115	116
	" " " "1917" ...	124	125
	" " " "1919" ...	170	172
	" " " "1920" ...	203	204
	" " " "1921" ...	205	207
17	Para. (6). Sub-para. Appendix ...	AI	A
44	Statement showing the details of cotton, &c.—		
	Serial No. 5, Column 2 ...	Sisorda.	Sisodra.
	" " Column 13 ...	3,324-4-6	33,324-4-6

CONTENTS.

	Paragraph.	Page.
Introductory ...	1-2	1
CHAPTER I.—Research and Investigation.		
Cotton Investigation ...	3—4	1—2
Sugarcane do. ...	5	2
Potato do. ...	6	2
Rice do. ...	7	3
Grass do. ...	8	3
Fodder do. ...	9	3
Wheat do. ...	10	3
Bajri do. ...	11	3
Fruit do. ...	12	4
Cardamom do. ...	13	4
Other Investigations on Crops and Plants ...	14	4
Cattle Investigations ...	15	4
Soil do. ...	16	4—5
Agricultural Engineering Investigations ...	17	5
CHAPTER II.—Demonstration and Propaganda.		
Definite purpose of the Agricultural Department should be increased in quantity or improvement in the quality of Agricultural produce. The work of the Department will be seen in the introduction of iron ploughs, foreign groundnut, new selected types of cotton, revival of grape industry of Nasik, improvements in sugarcane and potato cultivation, ridge system of cultivation of cotton and jowar, &c.	18—20	5—6
Division of charges into six each under a Deputy Director for Propaganda Work.	21	6
Popularity of improved cotton in Gujarat and particularly in the Broach and Panch Mahals District.	22	6
Distribution on an extensive scale of improved types of Kumta and Dharwar American cottons in Southern Division.	23	6
Accounts by the various Deputy Directors of the Propaganda Work.	24	6
Agricultural Associations, Co-operative Unions and the three Vernacular Agricultural Magazines conducted by the different associations.	25	6—7
Bulletins and Leaflets ...	26	7
Efforts for popularising demonstration and propaganda work of the Agricultural Department.	27	7
CHAPTER III.—Services undertaken for the Public.		
Services undertaken for the Public ...	28	7
Seed Supply ...	29	8
Implement Depots ...	30	8
Water Finding and Boring ...	31	8
Steam Ploughing ...	32	9
Fodder Storage ...	33	9
Supply of Premium Bulls ...	34	9
Famine Cattle Camps ...	35	9
CHAPTER IV.—Agricultural Education.		
Agricultural College and its increasing popularity ...	36—37	9—10
Agricultural Schools and their useful work ...	38	10
CHAPTER V.—Administration and Finance.		
Changes in the personnel due to leave ...	39—40	11
Expenditure, Receipts ...	41—43	11

APPENDICES.

	Appendix.	Page.
Report of the Agricultural College ...	A	13—21
Work done under the Deputy Director of Agriculture, C. D. ...	B	22—33
Work done under the Deputy Director of Agriculture, S. D. ...	C	34—39
Work done under the Deputy Director of Agriculture, Gujarat ...	D	40—69
Work done under the Deputy Director of Agriculture, Konkan ...	E	70—89
Work done under the Deputy Director of Agriculture, Sind ...	F	90—101
Work done under the Professor of Agriculture ...	G	102—107
Report of the Agricultural Chemist ...	H	108—111
Work done under the Economic Botanist ...	I	112—115
Report of the Plant Breeding Expert ...	J	116—120
Work done under the Plant Pathologist ...	K	121—122
Annual Report of the Soil Physicist ...	L	123—124
Report of the Deputy Director of Agriculture for Animal Breeding.	M	125—131
Report of the Agricultural Engineer ...	N	132—140

Annual Report of the Department of Agriculture, Bombay Presidency, 1920-21.

The purpose of the Agricultural Department is to ascertain by experimental investigation and research the methods by which the produce of agricultural activity can economically be increased in quantity and improved in quality, and then to get these methods introduced into practice. To achieve this purpose it maintains a corps of experts in Poona, and a body of men in every part of the Bombay Presidency, whose duty it is on the one hand to investigate such problems as arise, and on the other to place the results before the cultivators and adopt the best possible means to get them translated into practice.

2. In order to show the progress achieved I will divide the present report into the following sections:—

I. Research and Investigation.

II. Demonstration and Propaganda.

III. Services undertaken for the Public.

IV. Agricultural Education.

V. Administration and Finance.

I.

Research and Investigation.

3. So far as the Research Departments are concerned I can only refer to the most important matters which are under enquiry, with a short note on the results obtained. More details will be found in the appendices written by the various officers of the Department.

4. *Cotton Investigation.*—This has hitherto resolved itself almost entirely into a search for better types of plant than those now grown. This research, as was reported by Mr. Keatinge last year, has been successful in the Surat cotton area, and also in the Kumpta cotton area in the south of the Presidency, in each of which pure strains of cotton have been isolated, introduced into cultivation on a large scale, and are highly appreciated both by the cultivators and by the trade. We are not, however, staying there, and in the Kumpta cotton area, Mr. Kottur has succeeded in obtaining a cross between Kumpta and another type of cotton (*Gossypium neglectum*) which promises well to have as good a staple as Kumpta, but a much higher ginning percentage and a much better colour. It will be two or three years before this will be ready for distribution, but everything points to it as a very substantial advance.

Further selection of Surat has led to a further improvement on the "Surat I. A." now being distributed. This is being brought into large scale cultivation this year and now attention is being devoted to preparing by hybridisation a cotton which will be equal or nearly equal to "Navsari" in staple, but with a larger ginning percentage. The future in this matter is hopeful, but progress is necessarily slow. In the adjoining district of Broach, selection of strains of cotton suitable to this area is being carried on, and probably next year we shall be able to start distribution operations on a large scale. I may note that investigation on methods of increasing the yield of cotton at Surat by adopting a system of growing cotton on ridges is very promising, and has, so far, given excellent results.

Of other cottons, selection work on Dharwar American cotton has at last resulted in the development of a pure strain which has been called "Gadag No. I," and which is now being spread over the district.

In Khandesh, little research work has been done during the year, but henceforth, owing to a new provision for the purpose everything is favourable to the selection of pure strains having a high ginning percentage, with a much better staple than the "N. R." cotton now distributed by the Agricultural Department.

In Sind, the long continued testing of the suitability of various strains of American cotton has finally led to the conclusion that Punjab American F. 4 is the most suitable for Sind conditions and possesses considerable advantages over other types of American cotton, as well as over the ordinary Sindhi types. As against these latter it has been found (1) to mature earlier, thus releasing autumn irrigation for *rabi* crops, (2) to be more resistant both to drought and water-logging, and (3) to do well on light soils, where *deshi* Sind cotton cannot be grown with success, while as against other American varieties it is less susceptible to red leaf blight, and matures more rapidly.

There is found, however, to be very much possibility of improvement in the *deshi* Sind cotton, and selection in this variety has been pursued with all the vigour that the staff allowed. The result is that the Agricultural Department has now several excellent strains in hand, and of some of these, notably that to which the name "27 W. N." has been given, seed for over 500 acres has been supplied to the seed growers for multiplication in the current season. Selection is being continued with *deshi* Sind cotton specially with a view to improve it in ginning outturn and class.

One of the staff of the Cotton Department in Sind, Mr. K. I. Thadani, has been sent to the United States of America for special training and study of the selection and other methods of improvement in vogue there. His return in 1922 will mean the rapid increase in the activity of the department in research work in cotton suitable for Sind.

5. *Sugarcane Investigation.*—The investigation of the very many problems of sugarcane cultivation in Western India is largely concentrated at Manjri near Poona, though there have been important enquiries conducted also in the Gokak Canal area in the Belgaum district, in the south Surat District, and in the Konkan.

The work at Manjri has for many years been under the control of Mr. J. B. Knight, and in almost every detail of the tillage, treatment, manuring, and watering of the cane as well as in the handling of the produce, improvements have been introduced. The principal results so far reached at Manjri have been described in a bulletin* recently issued by the department. The chief matters now under investigation are as to how the present cost of manure can be reduced, and the discovery and development of alternative types of cane, chiefly early ones, to the Pundya variety now almost exclusively cultivated. Great success has been reached in both directions. Three of the varieties ("Red Sports," "Manjav," and "White Transparent") have given very largely increased returns under difficult conditions of limited water supply.

In the south Surat district a serious attack has been made at Amalsad on the very difficult question of the eradication of red rot in sugarcane in this tract, where it is the worst enemy of the crop. The investigation will take some years, but I have great faith in its ultimate success.

6. *Potato Investigation.*—The potato crop is not a very large one in Western India, but it is one with very great possibilities of extension. There are few crops, however, whose cultivation is surrounded by more difficulties than potatoes, and serious investigation into the crop and its troubles during the last years has increased vastly our knowledge of these, which are, almost all, entirely different from those known in Europe. During the year, under a committee presided over by Dr. Burns, progress has been made in the study of the "*Tambera*" disease and the various rots of the tubers. The "*Tambera*" disease is now definitely a conquered foe, and large scale demonstrations are being undertaken this year. These investigations have been partly financed by the Sir Sassoon David Trust Fund and partly by the Union Agency of Bombay.

*Bulletin No. 90, Work on the Manjri Farm, 1915-18, by J. B. Knight.

7. *Rice Investigation.*—Our research work on rice is developing. The Plant Breeding Expert has already been able to select strains from *kolamba* rice which will give at least 33 per cent. increased outturn, and even this result will probably be exceeded in the future. The multiplication of these high yielding strains will be the next step, together with the selection and development of others still more valuable. Very detailed work is also going on at the Karjat rice station to determine the various factors which contribute to obtaining a maximum yield of rice. This latter work will be ultimately of very great importance, and the cost of erecting a laboratory in connection with this study has been provided by the Sir Sassoon David Trust. In the case of rice the question of manuring assumes special importance, and the general value of bone meal as a manure has now been proved and is ready for extensive demonstration.

Investigation is also going on into the very difficult problem of the eradication of "*gonagar*" wild rice in the *mallad* tracts of the Southern Division. Decided progress is being made, but the problem cannot yet be considered to have been solved.

In Sind work on rice is chiefly conducted at Larkhana and is hampered by a very irregular water supply. But varieties have been discovered, ("*Sugdasi*," "Kangani" and "Sathri") which have given large yields even under unsatisfactory conditions of watering, and if this is confirmed a very valuable result will have been reached. Other investigations in hand at Larkhana deal with the question of the best seed rate in Sind, the best conditions of transplanting, and the best method of treating the seed bed. The results are not yet ripe for summarising here.

8. *Grass Investigation.*—This work has as its object the improvement of the great grazing areas of the Bombay Presidency and has been in the hands of Dr. Burns, and is partly financed by the Sir Sassoon David Trust Funds. The special object is the improvement of grass lands, particularly of those on poor soil. Many of these are unsuited to permanent cultivation, but their area is so great that if even a five per cent. improvement in the quantity of their produce is made the cattle position in the country would be materially altered. The results so far obtained seem to show that the very poor value of these cattle ranges is due primarily to overgrazing or to overgrazing following fire. If there is any method of resting a portion of the land each year there seems no reason why a very large improvement can be obtained even in the worst land. This problem has been solved by the people of some villages in the Nasik district, and Dr. Burns is finding the best way of giving the land the protection it needs to allow the development of better grasses.

9. *Fodder Investigation.*—Our work in this direction has chiefly consisted in perfecting the system of using emergency fodder like *prickly pear* under famine conditions, where a distinct advance on the methods previously followed has been made, and in the discovery of new and useful fodder crops. Sunflower has proved to be of great promise at the Gokak Farm, and *shevri*, (*Sesbania aegyptaaca*) seems capable both in the Deccan and the Konkan of being made to yield far more fodder than has ever been obtained before.

10. *Wheat Investigation.*—Little can be stated as to progress with investigations on the improvement of wheat. The selection of pure strains suitable to the Deccan has been carried on at Poona, and of those suitable to Sind at Mirpurkhas and Sukkur. In both cases striking preliminary results have been obtained, and I hope that next year I may be able to report a considerable advance. Apart from this the testing and introduction of the improved strains of wheat (Pusa 4 and Pusa 12) developed by Mr. Howard in North India has gone on on a very large scale.

11. *Bajri Investigation.*—A matter which has just been taken up, again with the help of the funds from the Sir Sassoon David Trust, is the selection of drought resisting strains of *bajri*. The work undertaken this year is almost entirely in the nature of reconaissance, and direct results cannot be expected for some years, but they will be of very great importance when secured.

12. *Fruit Investigation.*—The results of many years works on the mango have been published during the last year, but vigorous work is going on both at the Ganeshkhind Gardens and in the Konkan on the grafting of the crop, on the treatment of its diseases, notably the loss due to the fruit not setting. This last affection seems to be very largely due to an insect—the mango hopper—and the best method of dealing with this is under close study.

The work on other fruits follows chiefly on the lines sketched by Mr. Keatinge in previous reports and now we have an officer specially and solely for horticulture, work in this direction should go ahead with great rapidity. This is important because there is great scope for the development of the fruit industry in Western India.

13. *Cardamom Investigations.*—A very interesting piece of work which has been conducted by Mr. D. L. Sahasrabuddhe ever since 1914 is that into the problems of the Kanara spice gardens, and chiefly into the deterioration of the cardamom cultivation there. He seems to have shown its close connection with the excessive growth of certain protozoa in the soil, and has devised methods which are now being very successfully dealing with the trouble. This investigation is also aided by the Sir Sassoon David Trust Fund.

14. *Other Investigations on Crops and Plants.*—Smaller pieces of work in hand are those into the manuring of onions and other garden crops, and into a fungus disease of onions which has appeared very seriously in the Konkan, and into a disease of *jiru* in Gujarat; those into the adaptation of crops to new conditions in the case of *jowar* and many other crops of the Deccan to *varkas* land in the Konkan, those into the physiology of certain weeds, especially of *lavala* (*Cyperus rotundus*) with a view to its destruction; those into the weed pests of canals in the Deccan; those into the best and most economical applications of artificial manures to crops under the conditions of Western India and a number of others.

15. *Cattle Investigations.*—The cattle investigations consist chiefly of efforts to maintain and improve the chief breeds of the Presidency. So far we have only been able to establish Farms for this purpose for the Kankrej breed of Gujarat at Chharodi and for the Mysore breed at Bankapur. The former is now of old standing, and the herd there, which is regularly drawn upon for breading bulls for the villages, is certainly the finest collection of typical Kankrej animals in India.

Research is also being directed to the improvement of both the Kankrej and the Sindhi animals as milkers, the former in Gujarat and the latter at Poona, with the result that our dairies are gradually eliminating all but the best milk stock, and their yield of milk per animal is increasing, while we shall henceforward be able to distribute a limited number of bulls derived from known good milking strains.

The cattle work in process of very rapid development and the primary object at present is to establish a breeding herd of the finest types of animals for each of the great breeds of the Bombay Presidency.

16. *Soil Investigations.*—By the appointment of a Soil Physicist during the last year, it has been possible to undertake work of a fundamental character on the method of maintaining a higher amount of water in the soil of dry areas, and of increasing the quantity of water that is retained. The results from this ought to be seen within a year or two, and I anticipate great developments in this direction.

I want to draw attention to the great practical importance of these inquiries. The great question of increasing the production of the land in the country seems primarily to depend on the development of larger yielding types of crop, on the control of plant diseases and pests which lead to the loss of crores of rupees of value each year, and last, but by no means least, on the better utilization of the water supplied by rain in non-irrigated as well as of that supplied from other sources in irrigated areas. It is to the study of how the soil can be made to store and retain more water for the use of crops than it now

does that the energy of the Soil Physicist will be chiefly devoted. I hope to be able to report very practical results of his enquiries in a year or two.

17. *Agricultural Engineering Investigations.*—Very carefully conducted investigations into the value and suitability of various types of motor tractor in the black soil areas of the Bombay Presidency have been conducted by the Agricultural Engineer, the results of which will be very shortly published.

Our knowledge of the sub-surface water conditions in the alluvial areas of Northern Gujarat is rapidly increasing as a result of the many borings made in that area, which I hope in the near future will enable us to forecast the character of the water likely to be tapped by boring. This will mark a great advance on the present system of taking one's chance of hitting water or not or of its being salt or fresh.

II.

Demonstration and Propaganda.

18. The one ultimate test of the success of an Agricultural Department and of the whole of its research, educational, as well as other activities is whether the recommendations made are actually brought into practice, and have resulted in increase in the quantity or improvement in the quality of the material produced. As a rule this will also naturally result in increasing the profit to the producers, that is to say, the cultivators. But I want to lay definitely down as the one purpose of our existence as an Agricultural Department—the increase in the quantity or the improvement in the quality of agricultural produce.

19. Our work is only finished in fact when we find that our recommendations have entered into the ordinary practice of the country and are carried out without any further stimulation. Matters have reached this stage with only a few of our recommendations of past years. For instance, iron ploughs have in many parts of the country become the ordinary cultivation implements, and the only further work to be done is the organisation of supply, which can better be done by Co-operative Societies or the trade. Again, the foreign groundnuts, which the Agricultural Department introduced are now wanted by everybody, and on the basis of their cultivation, groundnut culture is extending into areas where it was never found before. Again, the new selected types of cotton, which we have discovered and maintained are now in demand in Surat, Dharwar and Khandesh, and the question is to organise the supply on an ever larger and larger scale. Again the whole grape industry of Nasik has been revived and put on its feet by the introduction of spraying against mildew introduced by the Economic Botanist and his staff, which is now universally adopted. There are a number of other cases of complete success, where the recommendations made by the Agricultural Department as the result of research need no further pushing, and the most that is required is the organisation to supply a general demand that has arisen.

20. There are other improvements which have not yet reached this stage, but which are in our opinion ripe for general use. Various improvements in sugarcane cultivation in canal and other areas are among these. The use of seed treatment of *jowar* as a complete preventive of smut; the adoption of other implements likely to be of great service as the plough; the various improvements in potato cultivation; the better methods of treating fruit orchards; the increase of crops in a normal year and their saving in a year of short rainfall by tillage methods worked out on the Agricultural College Farm; the ridge system of cultivating cotton and *jowar*, in the black soil areas of the Surat district; the use of bone manure for rice in the Konkan; the utilisation of *varkas* land for crops not now grown in the Ratnagiri and Kolaba districts; the large scale introduction of improved wheat and cotton in Sind; all these are matters which have now, with many others, passed beyond the stage of experiment, and need to be got into practice. These improvements are good but introduction of these matters into general use is very slow, and in some cases seems to make far less progress than could be desired.

21. For propaganda purposes the organisation we have at present is as follows:—The Bombay Presidency with Sind is divided into five divisions each in charge of a Deputy Director of Agriculture, who is in charge of all propaganda in his division,—except that for certain special purposes like cattle breeding and horticulture, we have one special officer at Poona, who directs propaganda work throughout the Presidency. He (the Deputy Director) has control of a number of Farms, which are partly experimental but are partly also worked as demonstration centres, and in addition there is an agricultural graduate as overseer in almost every district, who generally has one or more demonstrators of various grades under him, and is himself in most cases supervised by a Divisional Superintendent, kept solely for demonstration and propaganda work. These men work by means of demonstration plots under our own management, by demonstrations conducted on cultivators' fields, by organising the cultivators into associations for specific purposes, by distribution of leaflets as regards particular improvements and by moving among the people and giving information by word of mouth. It was decided during the year to increase the number of divisions each under a Deputy Director to six, and the decision has been carried into practice since the end of the year under report.

22. So far as actual results of propaganda are concerned undoubtedly the biggest success during the year was the extension of the area under improved cotton in the Surat district where our seed has come to enjoy a tremendous popularity, and where work has been carried on with the help of a committee of cultivators and the local trade in Surat. The work owes, most largely, its success to the work of Mr. Bhimbhai M. Desai, Deputy Director of Agriculture, Gujrat, and a large demand which it is now difficult to meet, for improved seed has arisen in the Broach and Panch Mahals districts. I estimate that the increased value of the cotton crops of the Surat district to the cultivators as a result of the seed originally developed on the Surat Farm was at least five lakhs of rupees in 1920-21. The premium on the cotton grown in the few thousand acres supervised by us was alone about 1½ lakhs of rupees.

23. Similar work, with improved types of Kumpta ("Dharwar No. I" and "Dharwar No. III") and Dharwar American ("Gadag No. I") cottons has extended very widely in the Dharwar and Bijapur districts, largely in co-operation with co-operative cotton sale societies. The amount of seed of these types distributed in 1920 was nearly 4½ lakhs of pounds or enough to sow about 30,000 acres. Each of these acres may be a source of seed supply in the following year, and so rapidly increase the area of these improved cottons,—while we are using the Farms of the department as a continual source from which new supplies of guaranteed pure seed can be obtained. The organisation is described in Appendix C in the report of the Deputy Director of Agriculture, Southern Division.

24. I must refer to the accounts by the various Deputy Directors of this work for a detailed history of the work undertaken. But I must draw special attention to one or two aspects of it and notably to the success of demonstrations organised on cultivators' fields,—as for instance in the use of Sulphate of Ammonia as a manure for sugarcane which is now well established in the Deccan Canal tracts, and in many other places. The experience of this, as well as of previous years, is that demonstration Farms under our own control are far inferior as methods of propaganda to the subsidising and helping of similar work on the fields of the cultivators themselves. At the same time the Farms of the department have been used as far as possible as demonstration centres throughout the year.

25. The need for local bodies of cultivators thoroughly impressed with the need of agricultural improvement and ready to organise the trial of any improvements and its extension if a success is very great. It has been filled in a measure by the organisation of agricultural associations of which there are now 68 in the Bombay Presidency in many parts of the country and by the work of co-operative unions in others. Agricultural associations have been specially successful in Khandesh, and in some parts of the Southern Division, though in the latter area their place is being taken, in a measure, by co-operative organization. Three of the most important agricultural associations carry

on agricultural magazines in vernacular. The Deccan Agricultural Association continues to bring out the monthly "*Shetki and Shetkari*" in Marathi. The Dharwar Agricultural Association publishes the "*Vakkaligaru Vakkalitanavu*" in Kanarese, while the Broach Agricultural and Industrial Association issues quarterly the "Gujarat Agricultural and Industrial Quarterly" in Gujarati.

The development of propaganda by means of local bodies of any of these types is now under very careful consideration and it is hoped that great progress will be made in the current year.

The propaganda of the Agricultural Department is done in part, both directly and indirectly, by means of publications of which the following have been prepared and issued (or arranged for) during the year under report. Some of those announced in last year's report have also been issued in the present year:—

Bulletins.

No. 105.—The Groundnut Bug and its control.

No. 106.—Dharwar American cotton: its history, cultivation and improvement.

No. 107.—*Gonag*, a Weed in drilled Paddy.

No. 108.—Summary of the work done on the Jalgaon Farm.

No. 109.—The crops of the Bombay Presidency: their Geography and Statistics.

Leaflets (with vernacular versions).

No. 5 of 1920.—Cultivation of Upland cotton in the Southern Maratha Country.

No. 1 of 1921.—Hand tools to remove thorns from prickly pear.

No. 2 of 1921.—Chaff cutters for economising Kadbi.

No. 3 of 1921.—The use of the Reaper in cutting grass.

No. 4 of 1921.—The manuring of Onions.

27. The demonstration and propaganda work of the Agricultural Department is difficult, and a great deal of credit is due to many of the staff of the department, and also to local workers for the way in which they stick to the work until it is a success. It is essentially missionary effort, and is often very depressing and disappointing to a degree. But the satisfaction of seeing a crop of *jowar* free from disease, while all around the crops have a loss of 20 per cent. through smut and of seeing the simple method of preventing it spreading among the people,—or the pleasure of watching year by year the extension of the use of the iron plough which gives better work and dispenses with one-third of the bullock power required otherwise,—or, again, the satisfaction of seeing an improved type of cotton extending, or a newly introduced crop gradually taking hold, all these form the rewards of those who undertake the task of popularising agricultural improvements among the somewhat inert though not over-conservative cultivators of Western India.

III.

Services undertaken for the Public.

28. Apart from the direct propaganda activities of the Agricultural Department, there are a number of services which it undertakes which in most other countries are undertaken by private agency, and which in future years may be undertaken here by such agency. Some of these services may be here referred to.

29. *Seed Supply.*—The first of them is the organisation of the supply of pure seed. The present organisation of the supply of pure cotton seed is an example. The original seed is produced by our breeders, and new freshly selected pure seed is provided by them in limited quantities every year. The amount is multiplied on our Farms, whether in Sind (Mirpurkhas), Khandesh (Jalgaon), the Southern Maratha Country (Dharwar) or Gujarat (Surat), until there is enough to sow an area say of from five hundred to two thousand acres as the case may be. This is then given out to cultivators or groups of cultivators to grow under the supervision of the department, and the seed from the produce is either purchased by the department for further distribution at approximately cost price, or by co-operative or other agency under arrangements made with us. This means a large organisation, but until competent private or co-operative agency takes this matter off our hands, it must continue.

I have described what is done in the case of cotton, but the method is analogous in other cases, and more than this, we are often the only buying agent available for the obtaining of seed of one district for transfer to another, Akola *bajri* and Parner wheat are examples. Another analogous service has been the supply of nursery plants and trees from the Ganeshkhind Gardens.

30. *Implement Depots.*—Another need, which was great a few years ago, but which is gradually being transferred to co-operative, private and other agency, is the establishment of depots for the sale and hire of implements, notably iron ploughs. These have been a special feature of the Central Division where until recently over forty such *depots* have been maintained. As private and co-operative agency develops, these are gradually being closed.

31. *Water Finding and Boring.*—Other great needs of the public which we have organised ourselves to meet are the application of Mansfield's water-finder in the trap area, where it has proved very successful, and the supply and use of boring tackle for obtaining underground water for irrigation in many parts of the Bombay Presidency.

As far as the water-finder is concerned, the work has involved visits to the land of forty-nine cultivators in the year, no less than 213 spots being tested in nine districts, and water was detected in the holdings of twenty-one of the holdings examined. The demand is far greater than the water-finder we have is able to fill, as the work with this instrument is slow and the interpretation of the results rather difficult.

The second line of work is that of shallow boring. All the boring machines belonging to the department have been in use, and a full tabulated statement of the results is shown in Appendix N to the present report. These results may be summarised as follows:—

Serial No.	District.	Number of bores.	Number successful.	Number unsuccessful.	Remarks.
1	Kaira ...	58	47	8	
2	Ahmedabad ...	12	8	2	
3	Broach ...	12	6	3	
4	Panch Mahals ...	9	9	...	
5	Thana ...	36	22	5	
6	Nasik ...	7	3	1	
7	Kolaba ...	5	2	1	
8	Khandesh ...	3	...	...	
9	Poona ...	4	1	1	
10	Surat ...	4	2	1	
11	Satara ...	6	5	...	
12	Bijapur ...	9	8	1	
13	Dharwar ...	9	8	1	
14	Sholapur ...	5	5	1	
15	Belgaum ...	1	1	1	
16	N. Kanara ...	1	1	...	
17	Ratnagiri ...	2	1	1	
18	Ahmednagar ...	13	1	...	

The value of boring for agricultural purposes thus differs widely in the different parts of the Presidency, and this has to determine the distribution of the machines belonging to the Agricultural Department. But the work is valued intensely, there are usually ten times as many applications for the machines available than can be filled in any year, and a successful result means such an increase in the certainty of obtaining a crop that boring seems a very valuable service not only to the cultivator in question, but to the country at large. A scheme for the expansion of the Boring Department has been placed before Government during the year under report, and is now under consideration.

32. *Steam Ploughing.*—Another service to the public which has been initiated and carried on for a number of years is the deep ploughing of land, (sixteen inches deep) by means of steam tackle for the removal of the deep rooted weeds which are such a curse to the country. This work has been carried on, during the present year, in the Dharwar district, and has been generally so successful that the whole tackle is now to be handed over to private enterprise. Two offers to purchase the tackle have been received, and are under the consideration of Government.

33. *Fodder Storage.*—The storage of fodder, whether *jowar kadbi* or grass, on a large scale and in some cases in a portable form is a new thing in this country, but has always appeared to be a profitable as well as useful operation in a country afflicted with fodder famine and hence with large changes in price from year to year. Some time ago, Mr. Keating, with the help of the Sir Sassoon David Trust Fund, initiated a scheme which was intended to show that the storage of grass in Upper Gujarat against years of fodder scarcity was a paying proposition. The result has been all that he anticipated, and a considerable profit has been made up to date, which will allow of larger operations in future. The plan was to buy grass when cheap, store in Dutch barns and keep it till it was saleable at a remunerative rate, though it was not to be kept for more than three years. A full account of the financial side of this scheme will, I hope, be published in the coming year.

A similar scheme for the storage of shredded *kadbi* in a baled condition was commenced after the famine year of 1912 in the Ahmednagar district, at Kopargaon, and the result has been that in each of the recent famine years large quantities of such *kadbi* have been available. No less than 3½ lakhs of pounds of such first class fodder was supplied in the recent famine (1920-21) in that district. Similar operations are in process of being established at Karajgi in the Dharwar district on a much larger scale, and the plant will be working, all being well, in the coming season.

34. *Supply of Premium Bulls.*—The supply of breeding bulls of first class type is one of the present duties of the Agricultural Department and is under the control of the Deputy Director of Agriculture for Animal Breeding. In the Gujarat tract these are derived from our own herd of *kankrej* animals at Chharodi, and in Dharwar we have now a similar supply of the Mysore breed from a newly established herd at Bankapur. In other tracts we have, as yet, to purchase the best animals that our experts can find for the purpose. But there is an increasing demand, which will, I fancy, rapidly get larger as years go by.

35. *Famine Cattle Camps.*—We have undertaken also during the past year, the control of famine cattle camps in the Poona and Ahmednagar districts both for the Collectors of those districts and for charitable funds. On the whole, our work in this direction has been appreciated, and has been successful in carrying large number of cattle which would otherwise have died through the most trying period of the year, and then selling them in a condition which enabled them to do the season's work on the farms of the cultivators.

IV.

Agricultural Education.

36. The Agricultural College at Poona continues to be increasingly popular. Since the College buildings, after being used as a War hospital, were returned to their legitimate purpose in 1919, there has been a rapid increase in

numbers. From 1915-18, the average number of students was 125; in 1919, it rose to 170; and in 1920 and 1921, it was 203 and 205, respectively. There has been a large influx of students from other parts of India and notably from Burma, but no properly qualified student from the Bombay Presidency has been hitherto refused admission. The results of the University Examinations were satisfactory, and I think that there is no doubt that the College provides a sound and varied education. The tone of the College has been excellent and the spirit which prevails there is something of which the department may feel proud.

37. During the year an Associate Professor of Dairying has been appointed for one year in the first instance in the person of Mr. B. S. Patel, B.Ag., a distinguished *alumnus* of the College.

During the year too the land taken near the College for the development of horticultural teaching has been cleared and brought into order, and, just after the year under report closed, Mr. G. S. Cheema, the newly appointed Professor of Horticulture, joined the staff. In addition to the regular teaching body of the College assistance was given during the year by Mr. E. J. Bruen, Deputy Director of Agriculture for Animal Breeding and Mr. V. A. Tamhane, Soil Physicist to Government.

38. The following Agricultural Schools are now at work and the number of students at each school is shown below:—

Marathi	Loni	... 52
	Jambul	... 30
	Alibag	... 12
Kanarese	Devi Hosur	... 26
Gujarathi	Godhra	... 31
Sindi	Mirpurkhas and Sukkur	... 7

There were in all 158 students. In addition to the above, 17 boys at the Bhil School near Dohad received a special short course of agricultural instruction on the Muvalia Farm. I think there can be no doubt that these schools are doing useful work. They are a new idea in this country, but are slowly winning their way to popularity, but a big effort must now be made to reduce their *net* cost to Government.

The only school which does not seem to be really meeting a need is that in Sind and the matter of its future is under very serious consideration.

Proposals are under consideration for the establishment of a number of other schools, some of the same pattern as the above (Bagalkot, Karad, Niphad), some as day schools (Dhulia, Surat, Jalgaon) and some with other modifications.

V.

Administration and Finance.

39. The control of the Agricultural Department was for eight months of the year under report in the hands of Mr. G. F. Keatinge, who has so long directed its operations, and under whose guidance it has developed to its present proportions. I took charge from him at the end of February 1921. Of the other principal officers of the department, Mr. Main returned to his position of Deputy Director of Agriculture, Sind, in November 1920, and Mr. Gilbert to his duty as Deputy Director of Agriculture, Southern Division, in January 1921. In the absence of these officers their work was done very efficiently by Mr. Gul Mahomed and by Rao Saheb M. L. Kulkarni, respectively. Mr. W. M. Schutte, Agricultural Engineer, went on short leave from September to December 1920, during which time his duties were carried on by Mr. C. G. Paranjpe. Mr. V. G. Gokhale, Deputy Director of Agriculture, Konkan, was absent on leave from January to May 1921, when Mr. K. V. Joshi, Rice Specialist, took his place,

The death of Mr. N. M. Chibber, Plant Breeding Expert, on January 1st, 1921, was a sad loss to the department which he had long and faithfully served. His place has been taken by Mr. R. K. Bhide, from the Economic Botanist's staff.

40. The following new positions in the Imperial Agricultural Service were filled during the year:—

(*a*) Deputy Director of Agriculture, Mr. W. J. Jenkins, M.A., B.Sc.

(*b*) Deputy Director of Agriculture, Mr. B. S. Patel, B.Ag., N. D. A., N. D. D. For the time being Mr. Patel is appointed to act as Associate Professor of Animal Husbandry and Dairying at the Agricultural College.

(*c*) Plant Pathologist to Government, Mr. S. L. Ajrekar, M.A.,

(*d*) Soil Physicist to Government, Mr. V. A. Tamhane, M.Sc., L.Ag.

The following positions in the Bombay Agricultural Service were created and filled during the year in consequence of the development scheme sanctioned by Government:—

(*a*) Mr. M. L. Patel, B.Ag.—Cotton Breeder, South Gujarat.

(*b*) Mr. D. P. Mankad.—Cotton Breeder, North Gujarat.

(*c*) Mr. S. H. Prayag, B.Ag.—Cotton Breeder, Khandesh.

(*d*) Mr. G. L. Kottur, B.Ag.—Cotton Breeder, Southern Maratha Country.

(*e*) Mr. C. S. Patel, L.Ag.—Cotton Superintendent, Surat tract.

(*f*) Mr. V. R. Dharwarkar, L.Ag.—Cotton Superintendent, Southern Maratha Country.

41. During the year the expenditure of the department amounted to Rs. 16,09,000 as against Rs. 13,09,000 in the year before. The increase is accounted for by the continually widening activities of the department, and by the opening up of intensive work in several new directions. Receipts amounted to Rs. 2,45,000 as against Rs. 4,22,000 in the previous year. As regards the Personal Ledger Account a special advance of one lakh of rupees in addition to the ordinary one of Rs. 50,000 has been temporarily sanctioned for the purchase of good selected Surat and Navasari cotton seed. Of this special grant only Rs. 75,000 has been utilised. Out of the total, Rs. 88,000 were advanced during the year and Rs. 65,000 recovered.

42. Grants were received from the Sir Sassoon David Trust Fund during the year amounting to Rs. 28,665. These grants were made for the following purposes:—

(1) Rs. 6,666 for study of the insect diseases of Jowar.

(2) Rs. 5,000 for investigations on improvement of grazing lands.

(3) Rs. 5,000 for studies on the eradication of weed.

(4) Rs. 6,666 for study of drought of resisting varieties of crops.

(5) Rs. 2,000 for study of the eradication of cardamom cultivation.

(6) Rs. 3,333 for study of the efficiency of agricultural implements.

It is difficult to overestimate the value of these grants, more particularly in the direction of financing investigations which could not otherwise be undertaker and the thanks of all interested in agricultural progress in Western India due to the fund established by the princely generosity of Sir Sassoon David. en,

43. As I was in charge of the varied operations of the Bombay Agricultural Department during only four months of the year, I cannot single out for special mention the work of any of the new numerous staff of the department. I wish, however, to place on record my appreciation of the arduous and successful work accomplished by many of the Agricultural Staff during the last year.

HAROLD H. MANN,

Director of Agriculture.

APPENDIX A.

Report of the Poona Agricultural College for the year ending 1920-1921.

This is the Thirteenth Annual Report of the Poona Agricultural College as a separate institution. The last year's increase in the number of the students practically has been maintained.

We were greatly honoured with the visit given us by the Hon. Mr. Sarma, Member of the Executive Council in charge of the Revenue and Agricultural Department and the Honourable Mr. Shafi, Member of the Executive Council in charge of the Educational Department of the Government of India. We were glad to have the opportunity of showing in details our methods of giving agricultural training to the students.

We are happy to be able to report that there was no outbreak of epidemics such as plague, cholera or influenza, which is quite common, and therefore our College work was carried out steadily throughout the year and without any interruption.

Buildings.

The temporary huts of the Deccan War Hospital are still standing on our estate, a part of which are being utilised for accommodating the overflow of students from the College Hostel and for other college needs, but we understand that they have been now sold by the Military Department and would be shortly removed. However arrangements have been made to retain a few that are absolutely necessary.

Optionals.

The Graduating class elected optionals as follows:—

(*a*)	Agricultural Economics, Land Development and Intensive Farming...	21
(*b*)	Stock Breeding, Feeding and Management including Dairying ...	11
(*c*)	Advanced Applied Botany ...	10
(*d*)	Advanced Agricultural Chemistry ...	3
(*e*)	Advanced Agricultural Entomology ...	3

I am still of the opinion that the optional courses at this stage of agricultural development of the country, are rather premature, there being not enough demand for specialists.

The special crop optionals have been continued in Optional A.

The subjects and number selecting each are:—

(1)	Sugarcane ...	5
(2)	Rice ...	3
(3)	Cotton ...	9
(4)	Wheat ...	2
(5)	Vegetables ...	2
(6)	Narcotics ...	–
(7)	Fruits ...	–

The agricultural section of the Syllabus is very defective and it is desirable to reconsider it at the earliest opportunity.

Examinations.

Of forty-one candidates who sat for the B.Ag. Examination, 38 passed with second class marks, no one having first class marks.

Seventy students were sent up for the I.Ag. Examination, two of which passed with first class marks and 43 with second class marks.

At the College Examination for the Diploma six out of seven candidates were granted the Diploma and all the 8 students that appeared at the Special (College I.Ag. Examination for the Diploma course) passed.

College Staff.

The Principal's duties for the year have again devolved upon the Professor of Agriculture.

Mr. S. G. Mutkekar was appointed as the Associate Professor of Agriculture and he relieved the Principal to a great extent by taking lectures in Agriculture and by managing "Shetki and Shetkari" the Marathi monthly.

Mr. G. B. Patwardhan, Mr. R. S. Kasargode and Mr. J. P Trivedi were on leave during the vacation which did not interfere with the College work.

Mr. B. S. Patel has been temporarily posted as Associate Professor of Dairying and Animal Husbandry at the College.

The present staff for teaching at the College is as follows:—

Professor of Agriculture	...	J. B. Knight, M.Sc.
Professor of Botany	...	W. Burns, D.Sc.
Professor of Chemistry	...	D. L. Sahasrabuddhe, L.Ag., B.Sc.
Plant Pathologist	...	S. L. Ajrekar, B.A. (Bom. and Cantab.).
Associate Professor of Dairying and Animal Husbandry.	...	B. S. Patel, B.Ag., N.D.A., N.D.D. (Eng.).
Assistant Professor of Agriculture	...	G. K. Ranade, L.Ag.
Assistant Professor of Botany	...	G. B. Patwardhan, B.Sc., F.R.H.S.
Assistant Professor of Chemistry	...	N. V. Kanitkar, B.Ag., B.Sc.
Assistant Professor of Entomology	...	R. S. Kasargode, L.Ag.
Assistant Professor of Physics and Mathematics	...	J. P. Trivedi, L.C.E.
Assistant Professor of Mycology	...	G. S. Kulkarny, M.Ag.
Assistant Professor of Dairying	...	H. G. Baluch, B.Ag.
Lecturer in Agriculture (Senior)	...	K. S. Kulkarny, B.Ag.
Lecturer in Dairying	...	H. M. Desai, B.Ag.
Lecturer in Veterinary Science	...	B. B. Joshi, G.B.V.C.
Lecturer in Chemistry	...	V. G. Patwardhan, B.Ag., B.Sc.
Lecturer in Entomology	...	V. G. Deshpande, B.Ag.
Lecturer in Physics and Mathematics	...	A. A. Vasavada, B.Ag.
Demonstrator in Agriculture (Senior)	...	G. P. Jambhekar, B.Ag.
Demonstrator in Agriculture (Junior)	...	T. N. Chaugule, B.Ag.
Demonstrator in Dairying (Senior)	...	H. Ezekiel, B.Ag.
Demonstrator in Dairying (Junior)	...	S. M. Patel, B.Ag.
Demonstrator in Botany	...	T. R. Khadilkar, B.Ag.
Demonstrator in Horticulture	...	P. G. Dani, B.Ag.
Demonstrator in Veterinary Science	...	S. N. Nadgir, G.B.V.C.
Demonstrator in Chemistry	...	S. J. Sabnis, B.Ag.

Students.

The number of students entering the class on July 1st was 84. The students come from all over India which shows the popularity of this institution.

Details for the last seven years appear below:—

	1915.	1916.	1917.	1918.	1919.	1920.	July. 1921.
First year students ...	35	54	58	61	60	89	84
Second year students ...	29	23	36	39	46	50	53
Third year students ...	31	35	23	35	38	48	49
Short Course students ...	27	Not held			23	12	13
Special and Post Graduate students ...	2	3	7	2	3	4	6
Total ...	124	115	124	137	170	203	205

The Statement below shows the localities from which our students are drawn :—

Locality.	1915.	1916.	1917.	1918.	1919.	1920.	1921.
Deccan and Khandesh ...	20	14	9	19	27	39*	29
Southern Maratha Country and Konkan ...	45	44	50	42	49	52	53
Gujarat ...	35	29	36	36	43	40	38
Sind ...	7	9	9	7	7	6	7
Assam ...	1	1	1	1	3	1	1
Central India ...	3	3	1	3		4	2
Nizam's Dominions ...	3	4	6	6	8	7	6
South India and Ceylon ...	7	6	5	13	16	23	18
Burma ...	1	2	5	6	7	19	30
United Provinces ...	2	3	2	2	1	2	
Berar ...				1			2
Bengal ...				1	4	7	8
Central Provinces ...					5	4	4
Nepal ...							1
Idar State ...							3
Madras ...							3
Ajmer ...							1
Total	124	115	124	137	170	203	205

It may be noted that 127 or about three-fifths come from the Presidency. The Southern Division leads even this year in taking advantage of the agricultural training. Compared with the last year there are 78 students from other parts of India instead of 67 last year.

By special arrangement we are training men for Burma Agricultual Department; hence there is such an exceptional increase in the Burmese contingent. This is the last batch which we have agreed to take from Burma.

Classification of the students according to communities :—

	1915.	1916.	191	1918.	1919.	1920.	1921.
Brahmins ...	55	49	55	61	68	84	76
Marathas ...	5	4	4	6	16	20	21
Lingayats ...	4	3	2	2	1	5	10
Patidars (Gujarat) ...	3	4	10	13	12	7	5
Jains ...					6	4	1
Mahomedans ...	12	10	8	4	9	12	15
Parsis ...	15	15	12	7	5	5	2
Christians ...	1	1			7	16	21
Ceylon Students ...					6	7	2
Budhists ...					7	9	16
Anavils (Surat) ...							2
Others ...	29	29	33	44	33	34	34
Total ...	124	115	124	127	139	203	205

Further classification shows that out of 127 students from Presidency only 38 or 30 per cent. come from the four chief agricultural communities of the Presidency, *viz.*, Marathas and Lingayats in the South and Patidars and Anavils in the North. Gujarat sending about 5% and the South sending about 25% of the agriculturists out of the total students of the Presidency. Is this possibly due to comparatively greater development of the Agricutural Department in the South or less appreciation of the College Students in the development and improved agriculture in the Northern Division? I think this point calls for consideration.

Courses.

Two regular courses of instruction are as usual offered at this College—

(1) The three years' course open to the students qualified according to the rules of the Bombay University.

The Principal may also admit a few other students to the course, and the successful candidates receive the College Diploma. The number 20 admitted in the last six years is as follows:—

1916—12 out of 54 equal to 22·2 per cent.
1917— 3 out of 58 equal to 5·1 per cent.
1918— 8 out of 61 equal to 13·1 per cent.
1919— 4 out of 60 equal to 6·6 per cent.
1920— 7 out of 89 equal to 7·8 per cent.
1921— 1 out of 84 equal to 1·2 per cent.

As a rule students of the Presidency proper are not admitted under these special conditions.

(2) The other course devised to give good practical working knowledge of improved agriculture in one year has been maintained.

Scholarships.

Fifteen candidates who have passed the Previous Examination of the Bombay University or obtained the certificate from the Principal of an Arts College instead, have been selected by the Director of Agriculture in consultation with the Principal of the College for the scholarships offered by the Government. These scholarships are given by preference to the sons of cultivators and are awarded for three years. Three of these receive scholarships during the first year of an Arts College.

The allotment by Divisions of these Government Scholarships during the last seven years is as follows:—

	1915	1916	1917	1918	1919	1920	1921
Deccan ...		3	3	3	5	7	4
Southern Maratha Country ...	5	5	7	2	4	4	2
Gujarat ...	2	2	3	6	3	1	2
Konkan ...	6	3	2	1	3	3	7

Library.

The library now numbers 11,478 volumes out of which 798 were added in 1920-21.

Other Institutions.

Besides the College proper the following institutions are utilised for teaching:—

(1) *Area attached to the Agricultural Branch.*—This consists of 185 acres. This area is used principally for giving practical training in the use of implements, growing all varieties of crops and for demonstrating different methods of growing these crops both under local methods and by showing all possible improvements. Many of the students are strangers to practical agriculture and therefore considerable time has to be spent in teaching the student to learn the work by doing it himself.

In the report of the Professor of Agriculture some of the yields grown on this area are given.

(2) *Manjri Sugarcane Experiment Station.*—Of the students electing optional A, five specialised in sugarcane cultivation. These men went weekly to this station and carefully studied the cultivation of this crop both practically in the field growing

a plot each with their own hands, in the gurhal shed where they were drilled in the boiling of the juice and in the laboratory of the station in the control methods of gul manufacture.

Another great purpose served by this farm is that of a model experiment station where the most exact methods of field experimentation can be demonstrated to the whole class.

(3) *College Dairy.*—The farm is of 353·14 acres including Manjri Kuran. The Economic growing of fodder is demonstrated. The herd numbers 88 buffaloes of three breeds and 83 cows of three breeds (including in each case young stock). The Dairy room is fitted with a small pasteurizer, separators, churns and butter workers of various patterns for demonstration to the students. Individual attention is being paid to the students in teaching practical dairying. Students are taken to the Government Military Dairy, Kirkee, for teaching dairying on factory scale, thanks to the courtesy of the Military Dairy authorities. The new proposed dairy school will greatly facilitate and improve the work in this line.

(4) *Karjat Rice Research Station.*—This station is utilised for training students who elected optional A, to specialise in Rice Crop.

(5) The cotton farms of Surat, Jalgaon and Dharwar right in the heart of the typical cotton districts of the Presidency prove very useful to supplement training in cotton specialisation afforded on the College area.

(6) *The Veterinary Dispensary.*—Practical training in the study of internal and external structure of agricultural animals and their treatment in diseases are given in this dispensary.

The details of the working of the Hospital are in the Appendix A1 under the separate heading.

(7) New appointment of Mr. G. S. Cheema, M.Sc., to the post of the Horticulturist and the Professor of Horticulture at the College has been made and we expect him to take charge of the work soon. The newly acquired land of Modi Bagh is being utilised for Horticultural teaching and the Ganeshkhind Botanical Gardens will only be supplementary.

(8) The Herbarium and Botanical Laboratory of the Economic Botanist are utilised for the advanced students in Botany.

(9) The Plant Breeder has his plots this year at the Ganeshkhind Botanical Gardens and Karjat which are convenient for demonstration to the students.

(10) Agricultural Chemist's Research Laboratory provides materials for instruction to the students selecting optional D.

(11) Agricultural Engineer's Workshop and Wells are available for teaching agricultural engineering, especially the mechanical part of it.

(12) The office and the Laboratory of the Plant Pathologist and that of the Soil Physicist are both located in the College buildings and are very useful for instruction to the senior students in respective branches.

(13) The Deputy Director of Agriculture for Animal Breeding took lectures in Animal Breeding and relieved the Professor of Agriculture a great deal.

The College Gymkhana.

The students maintain a Gymkhana which carries on the following activities :—

(I) The publication of College Quarterly.

(II) The holding of weekly lectures and debates over which prominent men from outside are often invited to preside, thus creating a greater interest in the agricultural work amongst the public.

(III) The tennis branch maintains three courts.

(IV) The foot-ball branch maintains a foot-ball team. The Hockey branch maintains Hockey team. A gymnasium is also maintained and is well taken advantage of. A department of minor games has been introduced and it maintains Ping Pong, Badminton, &c.

(V) The cricket team was also in the field, a new temporary ground being secured for the purpose.

(VI) The Gymkhana maintains the students' reading room where 40 periodicals are taken.

By readjustment of the lectures there have been two evenings set free during the week which allows some spare time to the students to carry on Gymkhana activities.

The Special features of the Gymkhana.

1. One is the inauguration of the number of challenge cups presented to the Gymkhana by various members of the College and the Agricultural Department. The idea originated with Prof. J. P. Trivedi, who is the chairman of the Gymkhana and whose strenuous efforts coupled with the generosity of the donors have resulted into such endowments to the Gymkhana.

The list of the challenge cups presented for various items and names of the donors are as follows :—

Nature of competition.	Name of the present.	Name of the donor.
1. One mile race ...	The Gokhale Challenge Cup ...	Mr. V. G. Gokhale, D. D. of Agriculture, Konkan.
2. Obstacle race ...	The Sahasrabudhe Challenge Cup ...	Prof. D. L. Sahasrabudhe, Agricultural Chemist.
3. High Jump ...	The Baluch Challenge Cup ...	Mr. Baluch, Assistant Professor of Dairying.
4. Wrestling ...	The Patil Challenge Cup ...	Mr. P. C. Patil, D. D. of Agriculture, S. C. D., Poona.
5. Swimming ...	The Mutkekar Challenge Cup ...	Prof. S. G. Mutkekar.
6. Hill climbing ...	The Patwardhan Challenge Cup ...	Mr. Patwardhan, Assistant Professor of Botany.
7. Elocution ...	The Chakradev Challenge Cup ...	Mr. G. M. Chakradev, B.A.
8. Badminton ...	The Kulkarni Challenge Cup ...	Mr. G. S. Kulkarni, Assistant Professor of Mycology.
9. Tennis Singles ...	The Modak Challenge Cup ...	Messrs. A. B. Modak & Brothers.
10. Inter College Tennis tournament.	The Trivedi Inter Collegiate Tennis Singles Challenge Cup.	Mr. J. P. Trivedi, Assistant Professor of Physics and Mathematics.
11. Inter College Foot-ball Match.	The Badami Inter Collegiate Foot-ball Challenge Cup.	Mr. S. R. Badami, B.Ag.

The above were announced in December 1920.

Donations received in June 1921 are as under :—

Nature of competition.	Name of the present.	Name of the Donor.
1. An Honour Cup for attendance.	Knight Honour Cup for attendance ...	Principal J. B. Knight.
2. Gymnasium Statues ...	Rupees 50 ...	Dr. Burns, Economic Botanist.
3. For the Physical Training Class.	Rupees 30 ...	Do. do.
4. Ploughing Contest ...	A Trophy for the best ploughman ...	Prof. B. S. Patel (Dairying and Animal Husbandry).
5. For putting the shot ...	A Challenge Cup for putting the shot.	Mr. E. J. Bruen, D. D. of Agriculture for Animal Breeding.
6. Long jump ...	A Challenge Cup ...	Mr. W. M. Schutte, Agricultural Engineer.
7. Statues for the gymnasium ..	Rs. 20 ...	Mr. V. A. Tamhane, Soil Physicist.
8. Boxing gloves ..	Rs. 30 ...	Mr. J. P. Trivedi, Assistant Professor of Physics and Mathematics.
9. The Physical Training Class	A Bugle ...	Do. do.
10. For the best collection brought to the students' museum.	A Challenge Cup ...	R. S. M. L. Kulkarni, D. D. of Agriculture.
11. For an Essay on Village Economics.	A Challenge Cup ...	Mr. V. K. Kogekar, Divisional Supdt. of Agriculture, C. D.
12. Tennis doubles ...	A Challenge Cup ...	Mr. E. W. B. Dias Bandarnayake, College Diploma Holder.

2. The other special feature of the Gymkhana is the organisation of the physical culture class under the Directorship of Dr. Burns who takes special interest in such activities. Over 75 per cent. of the College students have volunteered for this corps.

We are often questioned as to what our graduates engage in after completing their college course. The following is a partial list, a part of which has been copied from the Calendar of the Agricultural College and brought up-to-date:—

1906—Total number 7—

Agricultural Department	... 6
Private Work	... 1

1907—Total number 11—

Agricultural Department	... 4
Baroda State	... 1
United Provinces Agricultural Department	... 1
Private Work and unknown	... 4
Dead	... 1

1908—Total number 21—

Agricultural Department (Bombay)	... 3
Other Government Departments (Bombay)	... 5
Agricultural Department (C. P.)	... 1
Private Work of various kinds	... 3
Unknown	... 7
Agricultural Education (Central India)	... 1
Pusa Agricultural Research Institute (Bacteriological Department)	... 1

1909—Total number 28—

Agricultural Department (Bombay)	... 9
Agricultural Department (C. P.)	... 2
Agricultural Department (Baroda)	... 2
Other Government Departments	... 7
Agricultural Department (Dacca)	... 1
Agricultural Department (Central India States)	... 1
Unknown	... 5
Agricultural teaching (Privately)	... 1

1910—Total number 36—

Agricultural Department (Bombay)	... 11
Agricultural Department (Baroda)	... 4
Agricultural Department of other States	... 2
Agricultural Department (C. P.)	... 1
Agricultural Departments (Assam, Bengal, &c.)	... 2
Private Farming, &c.	... 3
Educational Work	... 2
Other Government Departments	... 3
Unknown	... 7
Court of Wards	... 1

1911—Total number 20—

Agricultural Department (Bombay)	... 5
Agricultural Departments of other Provinces and States	... 7
Other Government Departments (Bombay)	... 1
Forest College, Dehra Dun	... 1
Municipal Service (Sewage Farm)	... 1
Educational Work (not Government, but Agricultural)	... 1
Private Work	... 1
Unknown	... 3

1912—Total number 22—

Agricultural Department (Bombay)	... 9
Agricultural Departments (Other Provinces and States)	... 3
Other Government Departments (Bombay)	... 2

Unknown	... 5
Private Work	... 1
Educational Work	... 1
Dead	... 1
1913—Total number 14—	
Agricultural Department (Bombay)	... 4
Agricultural Department (States)	... 1
Revenue Department (Bombay)	... 1
Registration Department (Bombay)	... 1
Private Farming	... 6
Unknown	... 1
1914—Total number 18—	
Agricultural Department (Bombay)	... 6
Agricultural Department (Provinces and States)	... 6
Revenue Department (Bombay)	... 2
Customs Department (Bombay)	... 1
Private Farming	... 2
Dead	... 1
1915—Total number 20—	
Agricultural Department (Bombay)	... 6
Agricultural Department (States)	... 2
Revenue Department (Bombay)	... 6
Educational Department (Berar and C. P.)	... 2
Private Farming	... 4
1916—Total number 23—	
Agricultural Department (Bombay)	... 2
Agricultural Department (States and Provinces)	... 6
Irrigatoin and Co-operative Departments (Bombay)	... 2
Private Farming	... 3
Education and other Industries connected with Agriculture	... 5
Municipal Service	... 1
Foreign Country for Higher Education	... 1
Unknown	... 3
1917—Total number 30—	
Agricultural Department (Bombay)	... 7
Bombay Revenue Department	... 1
Agricultural Departments (States and Provinces)	... 3
Co-operative Departments (Bombay)	... 2
Education and other Industries connected with Agriculture	... 6
Private Farming	... 5
Unknown	... 6
1918—Total number 18—	
Agricultural Department (Bombay)	... 4
Agricultural Departments (States and Provinces)	... 3
Education and other Industries connected with Agriculture	... 5
Private Farming	... 3
Unknown	... 3
1919—Total number 27—	
Agricultural Department (Bombay)	... 10
Irrigation Department (Bombay)	... 1
Private Farming	... 5
Agricultural Departments of Native States	... 2
Revenue Department (Bombay)	... 1
Private Bodies	... 6
Unknown	... 2

1920—Total number 36—

Agricultural Department (Bombay)	... 15
Private Farming	... 4
Irrigation Department (Bombay)	... 1
Agricultural Department (States)	... 2
Co-operative Department (Bombay)	... 1
Agricultural Department (Burma)	... 3
Other Bodies	... 2
Post Graduate	... 1
Dead	... 2
Unknown	... 5

1921—Total number 68—

Agricultural Department (Bombay)	... 8
Private Farming	... 3
Co-operative Department (Bombay)	... 2
Agricultural Department (Burma)	... 1
Revenue Department (Bombay)	... 2
Agricultural Department (States)	... 5
Other Bodies	... 4
Unknown	... 13

The gross cost of working the College is worked out at Rs. which comes to Rs. per student.

APPENDIX A-1.

The details of the working of the Public Veterinary Hospital for the year as noted below:—

Patients treated.	1918-19.	1919-20.	1920-21.	Remarks.
Total ...	2,051	1,986	2,045	
In-patients ...	416	412	415	
Out-patients ...	1,635	1,574	1,379	
Treated on Tour ...	515	50	162	
Supplied with medicines ...	76	142	89	
Daily average attendance ...	37·99	36·44	36·49	
In-patients ...	14·99	19·37	20·08	
Out-patients ...	23·00	17·07	16·41	
Free patients ...	1,043	998	1,116	
Paid patients ...	1,008	988	929	
Agricultural Animals ...	1,106	1,120	1,179	
Non-agricultural animals ...	1,245	866	866	
Castrations ...	12	3	69	Including caponizing.
Attendance on Rinder Pest Out-breaks ...	16	24	40	
Attendance on Foot and Mouth Out-breaks ...	14	3	1	
Attendance on Blak Quarter ...			1	
Inoculations performed ...	817	1,380	1,088	

J. B. KNIGHT,
Principal.

APPENDIX B.

Summary of the work done by the Deputy Director of Agriculture, Central Division, Poona, for the year 1920-21.

Staff.—Mr. P. C. Patil, permanent Deputy Director of Agriculture, held charge of the office throughout the year, namely, till 30th June, when he proceeded on study leave to America for one year, and delivered over charge to me. Messrs. Kogekar V. K. and Athalye M. G. continued as Divisional Superintendents of Agriculture, Central Division and Deccan Canals respectively, for the whole year, except that the latter went on one month's privileg eleave and Mr. T. S. Swadi, Superintendent, Canal Farm, Gokak, S. D., acted for him. Mr. K. D. Kulkarni, Cotton Supervisor, having been asked to go on 6 months leave, the charge of his office was held by Mr. B. P. Vagholkar, Superintendent, Jalgaon Farm, in addition to his own duties. The other subordinate officers, *viz.*, Farm Superintendents and District Agricultural Overseers remained undisturbed in their own posts throughout the year.

During the year under report a small Demonstration Farm, to show all up-to-date improved methods of sugarcane cultivation to the sugarcane cultivators in the Nira Valley is started about 2 miles from Baramati, on the Baramati-Malegaon Road. A new graduate Mr. G. S. Marathe has been appointed to supervise the operations of the Farm.

Season.—The season as a whole, as far as the Central Division is concerned, was unfavourable both for Kharif and Rabi crops. In all districts, the pre-monsoon showers were very defective and the monsoon itself late and below average. The total rainfall in general was 50 to 70 per cent. below normal. Even in districts where sufficient rainfall had enabled Kharif sowings the crops suffered severely for the lack of moisture in their later stages of growth. Similar was the case with Rabi crops. Sugarcane suffered severely for want of sufficient canal water in Kharif season. Besides its growth was checked by the cold frosty weather in January and February.

In the Nasik District the cane crop suffered greatly from the ravages of rats in addition to the usual pest of wild pigs.

About 75 per cent. of cotton sowings in Khandesh districts, were completed in June before rains ceased. Sowings again commenced in July. Rains in August and September were very light after varying periods of drought. The crop thus suffered greatly from the general scarcity of rains throughout the season. In the light soil, the yield of cotton crop was barely 3 annas while on heavy soils it was between 5 and 8 annas.

In Nandgaon of Nasik district and particularly the whole of the unirrigated tract of Ahmednagar, there were no sowings, causing a great scarcity of fodder to cattle. The talukas of Shevagaon, Nevasa and Pathardi (Mahal) were amongst the most affected talukas in the Ahmednagar district and a number of cattle migrated to the Maval. Cattle camps maintained by the charitable Famine Cattle Committee and the Government, were started in Ahmednagar, Rahuri, Shevagaon and Nevasa talukas. Government opened grass depots in several places and Tagai was liberally granted to cultivators to save themselves and their cattle. Similar conditions prevailed in the eastern part of the Poona district.

On the Kopergaon Farm, Kharif Nilwa crop germinated well, but insufficiency of later rains checked the growth greatly. Lucerne was tried in several places both under well and canal irrigation but the crop suffered to a very severe extent from the sudden attack of disease.

Experimental and Research Work.

Cotton.

The organisation for supplying pure N. R. cotton seed to cultivators has been the same as described in the last year's report. Experience however shows that the seed produced in the third generation by members of the seed unions and seed societies does not remain as pure as that from the Farm. Rouging of mixtures of other types in the third generation under departmental supervision is impossible owing to the large area of crop at different places and the limited staff of the department. It has thus become a great problem as to how to keep the variety pure, after it is once given out from the Farm. The only possible way seems to be the organisations of Co-operative Seed and Cotton Sale Societies which would take up the work of distribution of pure N. R. seed for seed purpose, and destruction of other impure seed by selling the same as cattle food, &c.

During the year under report the Jalgaon and Dhulia Farms supplied 33,800 lbs. of pure seed to seed unions and seed-growers and the seed produced by registered seed-growers and seed unions amounted to 54,273 lbs. which was given to ordinary cultivators.

As already reported in the last year's report the Jalgaon Farm is utilized to work out the tillage and manurial problems on cotton for Khandesh. The experiments of crude night soil and castor cakes were continued and the results of five years as given below seem to be consistent, though the yields for the current year are high in spite of the unfavourable season. This is however due to the good and timely tillage operations given to the land:—

Manure used per acre.	Average yield per acre of seed cotton in pounds.					General average in lbs. of seed cotton per acre.
	1915-16	1916-17	1918-19	1919-20	1920-21	
Crude Night soil, 20-30 carts.	1,194·6	587·5		703·8	738·5	906·1
Farmyard manure, 20 carts.	649·51	485·45	658·8	578·9	646·1	603·75
Sheep folding, 2,000 sheep.	631·79	462·27	592·2	374·8	737·64	559·74
Castor cake, 400 lbs.				570·0	546·4	531·7
No manure ...	368·10	213·31	241·10		255·2	269·37

The use of castor cake as manure for cotton where Farm Yard manure is not available in sufficient quantity is being demonstrated by the district staff in cultivators' fields in different centres.

The experiments of comparative trials of the different local types were vitiated to some extent by the bad season. However the results as obtained are given below with the valuations and remarks made on their samples by Messrs. Tata & Sons of Bombay:—

Name of variety.	Average yield per acre in lbs. in 1920-21.	Ginning %	Valuation per candy=784 lbs.	Remarks by Messrs. Tata & Sons.
N. V. ...	345·71	35·18	320	Uniform and better than N.V.M. Good for 16s.
N. V. M. ...	301·42	30·87	290	Good for 14s.
N. R. ...	317·14	36·71	290	Best amongst short stapled cotton. Good for 12s.

The low yield of N. R. plot is due to its unfavourable position, *viz.*, stiffness and surface washing of the soil. Four strains of the cross Commilla and Bani, reported last year, were again tried during the year on a fairly large scale to test the yielding capacity of these strains, in comparison with N. R. The yields obtained together with their ginning percentages and valuations have been tabulated below :—

Name of variety or strain.	Yield per acre in lbs.	Ginning %	Valuation per candy=784 lbs.	Remarks by Messrs. Tata & Sons.
N. R.	750·95	35·22	290	Best amongst short staples. Good for 12s.
$C \times B \frac{12}{3 \; 14}$	647·71	36·87	295	Deteriorated. Good for 12s.
$C \times B \text{ II } B \frac{12}{3}$	603·80	36·68	340	Best and can spin up to 20s.
$C \times B \text{ IV} \frac{2a}{5}$	689·52	36·79	290	Deteriorated. Good for 12s.
$C \times B \text{ VI} \frac{1}{1}$	632·38	37·17	320	Good for 16s.

A special Cotton Breeder is now appointed who is stationed at the Dhulia Farm. All the selection and breeding work is now transferred to Dhulia, as this Farm is considered to be more suitable than Jalgaon for breeding work, owing to the special irrigation, &c., facilities it has.

Sugarcane.

The nature of the work undertaken in the sugarcane tract by the district staff under the supervision of the Divisional Superintendent of Agriculture, Deccan Canals, has been fully described in the last year's report. The same work is continued on extended scale especially in the introduction of concentrated manures., *viz.*, Ammonium Sulphate, as a top dressing for sugarcane in the canal tracts. The propaganda work undertaken has been a great success.

As stated in para. 16 of last year's report a grant of Rs. 10,000 obtained from Sir David Sasson Fund through the efforts of the Director of Agriculture, Dr. H. H. Mann, was spent for this propaganda work. Cultivators who were willing to carry out our instructions, were supplied with Ammonium Sulphate free of charge. Thus a large number of demonstration plots were arranged in different places. In the majority of these demonstration plots, Ammonium Sulphate has produced an increased outturn. The fact that during the year 1921-22, cane growers on the canal tract, have purchased independently of the department, nearly 800 bags, *i.e.* about 75 tons of Ammonium Sulphate, clearly proves that the grant of Rs. 10,000 obtained through the efforts of Dr. Mann, has attained the purpose for which such grants are made by the donors.

The Divisional Superintendent of Agriculture, Deccan Canals, has, during this year, taken a large number of comparative crop tests, in the demonstration plots in cultivators' fields, in different soils and localities. Each plot of Sulphate of Ammonia was provided for comparison, with a check plot receiving an equal amount of Nitrogen in the form of oil cake alone, and costing nearly the same amount for cultivation. In all the experiments, plots treated with Sulphate of Ammonia have given increased yields.

The average outturn of Gul from several plots in the three canal tracts is summarized below :—

Nitrogen applied in top-dressing in lbs.	Number of plots of which average is worked.	Outturn of Gul per acre in lbs.		Increase or decrease due to Sulphate of Ammonia.
		Plots treated with Sulphate of Ammonia.	Check plot.	
Plots on Nira Canal.				
160 ...	14	9,612	8,117	+1,495
200 ...	4	9,735	8,447	+1,290
250 ...	1	14,840	Nil.	
Plots on Godavari Canals.				
160 ...	7	11,965	10,410	+1,546
200 ...	2	14,940	13,200	+1,740
Plots on Prawara Canals.				
160 ...	5	8,800	8,678	+122

In the year under report the unit value of Nitrogen in Sulphate of Ammonia and oil cakes was nearly the same ; therefore, the cost of manuring and cultivation of Sulphate of Ammonia-plots and the check-plots was practically the same, *viz.*, approximately Rs. 800 per acre. Similarly a number of comparative field tests (46 in all) were taken by the Divisional Superintendent of Agriculture, Central Division, on the Kadwa and Girna Canals, wherein the application of Ammonium Sulphate alone, and with different oil cakes, as a top-dressing to sugarcane, was compared with several check-plots which either received only cakes as top-dressing or no top-dressings at all. His conclusions are as below :—

(1) Sulphate of Ammonia has increased the yield and has paid over and above the cost of the manure in all cases.

(2) Sulphate of Ammonia combined with safflower cake has given increased outturn of Gul than Sulphate of Ammonia with castor cake.

(3) Green manure with Sulphate of Ammonia is equally good as cake and Sulphate of Ammonia.

Cultivators on the Girna Canal have now begun to appreciate the use of top-dressing of Ammonium Sulphate to sugarcane and also the increased profits of cane cultivation by the application of Ammonium Sulphate, as a consequence of which the area under sugarcane is gradually increasing under that canal as will be seen from the following figures:—

Year.	Area under Sugarcane. A.	g.
1919-20	36	14
1920-21	49	14
1921-22	124	16

A beginning has been made to introduce certain new paying crops in the canal tract in rotation with sugarcane. For this purpose a number of demonstration plots were arranged and the results of some of the plots are given below:—

Name of Crop.	No. of plots of which results were available.	Average outturn per acre in lbs.		Remarks.
Plots on Nira Canal.				
Big Japan Groundnut ...	5	Nuts	1,512	
N. R. cotton ...	3	Seed cotton	1,244	The crop was top-dressed with castor cake and Sulphate of Ammonia.
Broach cotton ...	1	Do.	1,360	
Plots on Godavari Canals.				
Big Japan Groundnut ...	4	Nuts	2,877	Highest yield was 3,360 lbs. per acre.
N. R. cotton ...	2	Seed cotton	528	
Plots on Prawara Canals.				
Big Japan Groundnut ...	5	Nuts	2,330	Highest yield was 3,000 lbs. per acre.
N. R. cotton ...	2	Seed cotton	1,118	Highest yield was 1,600 lbs. per acre.
Turmeric ...	1	Do.	8,440	

From the average outturn figures given in the above statement, it can be said that cotton seems to be a suitable rotation crop in the sugarcane tract. Experiments on the Canal Farm at Gokak and trials in cultivators' fields at Sholapur prove the same thing. Similarly groundnut is another important paying crop, suitable to be introduced in rotation with sugarcane. But the great pest for this crop is the attack of wild pigs from the time of sowing till harvest. It is thus a problem before the canal cultivators to find out suitable remedies to minimise the pig pest.

The trial of Red Mauritius cane, for salt lands in comparison with the local Pundia, is continued on the Godavari Canals in cultivators' fields. The results so far go to show that the Red Mauritius cane thrives better on salt affected lands, than the common Pundia variety. In one case where the Red Mauritius and Pundia were grown side by side, the yields have been 7,440 and 1,820 lbs. of Gul respectively. This has attracted the attention of the Saswad Malis, who bought one acre of the standing crop of Red Mauritius cane for Rs. 1,300 for seed purpose and have planted therewith 12 acres of land, partly or wholly affected by salt. The progress of this crop is being carefully watched by the Divisional Superintendent and his staff.

Pig Killing Campaign in Nira Valley.

The campaign undertaken by the department since the year 1919, is conducted periodically every year. In the season under report 120 pigs were killed at a total cost of Rs. 1,176-13-0 or at an average of Rs. 9-13-0 per pig against Rs. 6-12-0 of the previous season. The increased cost in killing, is due to the animals having left the place temporarily. However the success of the campagin (though temporary) has attracted the attention of the Irrigator's Association in the valley and the association has collected a sum of about Rs. 750 to be given as contribution to the department, if the campaign is continued. Similarly people in the Godavari Valley have communicated their readiness to contribute up to half the cost if a campaign is undertaken by the department in the destruction of wild pigs in that tract.

Kopargaon Farm.

This Farm, though meant mainly for growing fodder crops, is utilized to a certain extent to demonstrate the most economic methods of sugarcane cultivation. For this purpose a plot of 5 acres and 35 gunthas is reserved for various experiments on sugarcane, *viz.*, methods of planting, trials of varieties and of different artificial manures for top-dressing, &c.

The result of outturn as obtained from the demonstration plots and from manurial series are given below for comparison :—

	Name of Variety.	Method of Planting.	Manurial Treatment.		Outturn of Gul per acre in lbs.	Remarks.
			Kind.	Quantity.		
		I. Method.				
1	Pundia ...	Local method 2½' apart.	Safflower Cake.	8 pallas (Palla =240 lbs).	11,810	Approximate Nitrogen 225 lbs.
			Castor Cake ...	12 do.		
2	Do. ...	New method 5½' apart.	Ammonium sulphate.	75 Nitrogen.	12,496	
			Fish manure ...	75 do.		
3	Do. ...	Modified West Indies, 3½' and 4½'.	Ammonium sulphate.	75 do.	14,072	
			Safflower Cake.	75 do.		
4	Do. ...	New method 5' apart.	Ammonium sulphate.	75 do.	8,092	
			Safflower Cake.	75 do.		
		II. Manurial Series.				
5	Pundia ...	New method 5' apart.	Ammonium sulphate.	75 Nitrogen.	9,904	
			Safflower Cake.	75 do.		
6	Do. ...	Do.	Sodium nitrate.	75 do.	11,596	
			Safflower Cake.	75 do.		
7	Do. ...	Do.	Ammonium sulphate.	75 do.	11,340	
			Groundnut Cake	75 do.		
8	Do. ...	Do.	Safflower Cake.	75 do.	12,624	
			Castor Cake ...	75 do.		

The outturn results show that 150 lbs. of Nitrogen given in Sulphate of Ammonia and safflower cake as a top-dressing to the modified West-Indies method of planting sugarcane, has given the highest yield of Gul. The results obtained here and elsewhere prove that Ammonium Sulphate is the most paying manure in the growing of sugarcane.

Among the varieties of canes tried, Manjav is found to be a heavy yielder and seems to be worth given out to the district staff for distribution.

2nd Ratoon of Sugarcane Varieties.—This experiment was especially undertaken on the suggestion of some members of the Sugar Committee who visited the Farm when they toured in this tract. The experiments tried, though on small scale, go to prove that some of the varieties give better outturn in the 2nd Ratoon crop, though planted in the wide method. Stripped Mauritius and Manjav seem to be the best.

The following statement gives the details of outturn :—

Name of Variety.	Outturn of Gul per acre in lbs.				Remarks.
	2nd Ratoon, 1920-21.	1st Ratoon, 1919-20.	Plant cane, 1918-19.	Average of 3 crops.	
Red Mauritius ...	6,429	9,134	9,981	8,514	
Green Mauritius ...	5,280	6,516	6,608	6,134	
Striped Mauritius ...	7,120	7,173	3,296	5,863	
Red sports ...	5,700	8,420	7,408	7,176	
B 376 ...	6,577½	7,111	7,432	7,040	
B 208 ..	3,200	5,100	8,448	5,583	
Manjav ...	7,107	8,413	3,648	6,389	

Power-crusher for Crushing Sugarcane.—"Chattaunga No. 92" crusher is worked by a Crude-oil Engine for crushing sugarcane on this Farm. The crusher is sometimes worked on hire, for crushing cane belonging to neighbouring cultivators also. During the year under report the total area of cane crushed by the Power-crusher was

22 acres, of which 6 acres were from the Farm and 16 acres belonged to cultivators. The crusher took 44 days for cultivators' work, and 30 days for Farm work. The slow work for crushing cane, *viz.*, 30 days to crush 6 acres of Farm cane, was due to the crop from various experimental plots, being crushed and boiled separately.

The rate charged for crushing cultivators' cane was Rs. 2-12-0 per pan. In all 732 pans of Gul were obtained from cultivators' crop, at an average rate of 16·6 pans per day. While only 307 pans of Gul were boiled from the Farm crop at an average rate of 10·2 pans per day. The total amount of hire realized for doing cultivators' work, was Rs. 2,013. The total expenditure to run the plants (both Engine and crusher) came to Rs. 1,141-7-2. Thus a sum of Rs. 871-8-10 is left as balance, towards interest, depreciation, &c., on the plants of an outlay of Rs. 6,800.

The spare cane crusher (Ruston Proctor) brought sometime ago from the Manjri Farm, is given on hire to a cultivator who has got his own Oil Engine. The hire charged is Rs. 3-4-0 per working day of the crusher. The crusher is giving very satisfactory work without any trouble. The average extraction was 72 per cent. of juice, while from ordinary bullock power mills, the extraction is not more than 63 per cent. The crusher was worked for 251 days from 13th October 1920 to 20th June 1921 and realized a hire of Rs. 815-12-0.

Fodder Growing and Storing.—The major portion of the area under fodder crops, is grown with Nilwa Jowar, as this is proved to be the most suitable fodder variety, for the Deccan conditions. Various other kinds of fodder crops, *viz.*, Local Jowar, Hundi, Maize, Lucerne, Guinea grass and Shevari are also grown for comparative trials and also to provide continuous supply of green fodder to Farm cattle. The following statement will give an idea of the total fodder produced on the Farm (both dry and green) during the year :—

Name of Crop.	Dry outturn.				Green outturn.				Total outturn of Bhusa.	Remarks.
	Area.		Outturn in lbs.	Average per acre in lbs.	Area.		Outturn in lbs.	Average per acre in lbs.		
	A.	g.			A.	g.				
Nilwa ...	78		271,052	3,475	2		16,273	8,136	2,200	
Jowar, Rabi ...	35	20	112,022	3,156	7	20	28,858	3,847	3,192	
Marvel grass ...	1		2,760	2,760						
Kolhapuri grass ...		10	800	3,200						
Hundi ...					5		18,575	3,715		
Maize ...					9		75,777	8,420		
Lucerne ...					2	5	86,399	40,658		1st year crop.
Do. ...					1	10	15,924	12,739		3rd year crop.
Guinea grass ...						25	2,417	3,867		
Shevari ...					1		14,677	14,677		
Cane tops ...					5	34¾	92,432	15,758		
Do. ...						17	6,125	14,411		
Gram Bhusa ...									19,057	
Total ...	115	10	386,634		78	31¾	357,507		24,449	

The subjoined statement shows that from 1917 to 1921, the Farm supplied over 9 lakhs pounds of dry Kadbi of which 3½ lakhs was supplied in the famine of 1920-21 :—

To whom supplied.	Where supplied.	Quantity of fodder supplied in lbs.	Remarks.
	1917-18.		
Military Department ...	Bombay ...	169,367	
Do. do. ...	Poona (Kirkee) ...	20,449	
	Total ...	189,816	
	1918-19.		
Government Farm ...	Surat ...	22,432	
	Total ...	22,432	

To whom supplied.	Where supplied.	Quantity of fodder supplied in lbs.	Remarks.
	1919-20.		
Cultivators ...	Yeola and Kopargaon taluka.	34,455	
Officers of the several departments.	Kopargaon, Nagar and Dhulia.	132,014	
Famine Relief Committee ...	Nagar ...	95,000	
Government Farms ...	Surat and Amalsad ...	90,000	
	Total ...	351,469	
	1920-21.		
Cultivators ...	Kopargaon taluka ...	232,045½	
Do. ...	Sangamner taluka ...	25,750	
Cattle camps ...	Kopargaon Farm and Lakh ...	3,218	
Officers of the several departments.	Kopargaon, Nagar, Yeola, Sangamner, Rahuri, &c.	89,060	
	Total ...	350,073½	
	Grand Total ...	913,790½	

From the large quantity of fodder given in the statement above it will be seen, how useful this Farm has been in supplying fodder in the famine of last year in the Ahmednagar district. A few more Farms of this type in different centres in the canal tracts in the Ahmednagar district would considerably help the fodder problem of this district. With this object in view it is contemplated to start another fodder Farm on the Pravara canal. It is hoped that this Farm will soon come out.

Gram.—As the area under fodder crops is large at this Farm, and as the manure supply is scanty, it was thought to introduce a good rotation crop which would both be paying to the Farm, and maintain the fertility of the soil. For this purpose gram was found to be the most suitable crop. A large area was thus put under this crop and the results are given below :—

Survey Nos.	Area.		Manurial treatment.	Yield per plot in pounds.		Yield per acre in pounds.	
	A.	g.		Grain.	Bhusa.	Grain.	Bhusa.
24	15	0	No manure ...	9,732	5,687	648	379
26	13	0	Do. ...	7,968	5,040	613	387
31	5	0.	Do. ...	5,004	2,662	1,000	532
31	11	0	Do. ...	8,208	5,668	746	515
	44	0					

Hundi as a Third Crop.—With the object to see whether it would be advantageous to take three fodder crops in one year under irrigation, a small experiment was laid out and the results obtained show that the time for the last crop is insufficient. It occupies part of the Kharif season of the following year. Besides the yield was poor and did not pay financially.

Among other varieties of fodder crops, Shevari seems to be the most suitable crop for the salt affected lands in the canal tract. In the Satara district Shevari and rice are grown in salt affected lands, the latter being harvested when ripe, and the former kept for three years. The salt land thus left under Shevari for three years, becomes fit again for growing moderate crop of sugarcane. It seems worthwhile to try these crops on the salt lands in the Nira Valley.

Shredding and Baling of Fodder.—During the year under report there was not much work for this plant as there was keen demand for loose fodder immediately after its harvest, owing to severe fodder famine in the district. The total quantity of dry Kadbi obtained on the Farm was 383,074 lbs. of which only 130,301 lbs. was baled in 2,726 bales. A loss of about 3 per cent. occurred in handling the loose Kadbi for baling purpose.

Distribution of Seeds, Manures and Implements.—The following statement shows the amount of assistance rendered by the district and Farm staff to the cultivators in the supply of special seeds and manures. Among the seeds distributed N. R. cottons, exotic groundnut and fodder seeds were the most prominent:—

Distribution of Seeds, Manures and Implements in Central Division in 1920-21.

Serial No.	Tracts.	Seeds.		Manures.		Implements.		Total value.	Remarks.
		Quantity in lbs.	Value.	Quantity in lbs.	Value.	No.	Value.		
			Rs. a. p.		Rs. a. p.		Rs. a. p.	Rs. a. p.	
1	Division proper ...	78,585	6,459 15 2	1,010,836	11,589 14 6	28	2,004 10 9	20,054 8 5	
2	Canal charge ...	23,779	4,138 12 3	230,160	15,411 2 3	53	2,467 7 6	22,017 6 0	
3	Farms ...	78,911		2,077		120	2,607 4 8		
	Total ...	181,275		1,243,073		201	7,079 6 11		

Hire of Implements at Depots.

Serial No.	Name of Depot.	Taluka.	District.	Hire collected during.						Remarks.
				1918-19.		1919-20.		1920-21.		
				Rs. a. p.		Rs. a. p.		Rs. a. p.		
1	Junnar ...	Junnar ...	Poona ...			9 1 0		69 10 0		
	Agricultural College Farm.	Haveli ...	Do. ...	44 3 0		81 6 0		36 3 0		Agricultural College Farm Depot transferred to Junnar.
2	Peth ...	Khed ...	Do. ...	9 2 0		29 10 0		22 7 0		
3	Loni School ...	Haveli ...	Do. ...	189 1 0		306 5 0		301 1 0		
4	Vagholi ...	Do. ...	Do. ...					61 1 0		Mandavgan Depot transferred to Vagholi.
	Mandavgan ...	Sirur ...	Do. ...	173 10 6		76 10 0		59 3 0		
5	Nanded ...	Haveli ...	Do. ...					96 4 0		Vadgaon Depot transferred to Nanded.
	Vadgaon ...	Do. ...	Do. ...	53 13 0		157 0 0		14 8 0		
6	Pandeshwar ...	Purandar ...	Do. ...	10 7 6		56 12 9		36 10 2		
7	Baramati ...	Bhimthadi...	Nira Canal, Poona.	42 14 6				71 1 0		
8	Vadgaon ...	Do. ...						15 14 0		
9	Sansar ...	Indapur ...						2 13 0		
10	Nagar ...	Nagar ...	Ahmednagar.	141 15 0		313 12 0		106 11 0		
11	Pimpalgaon Pisa ...	Shrigonda...	Do. ...	175 2 0		195 15 0		89 0 0		
12	Sangamner ...	Sangamner.	Do. ...	15 6 0		72 8 0		3 8 0		
13	Karjat ...	Karjat ...	Do. ...	19 5 0		22 13 0		5 8 0		
14	Shevgaon ...	Shevgaon ...	Do. ...	156 4 3		308 6 0		109 2 0		
	Newasa ...	Newasa ...	Do. ...	146 8 3		253 5 0		121 11 9		Newasa Depot abolished.
15	Kopargaon (a) ...	Kopargaon ...	Godavari Canal, Ahmednagar.	160 11 0		300 11 6		549 6 6		
	Kopargaon Farm ...	Do. ...		93 3 6				117 4 6		Kopargaon Farm Depot abolished.
16	Manjur ...	Do. ...		128 3 6		67 11 0		36 5 0		
17	Rahata ...	Do. ...		6 12 0				82 11 6		
	Pohegaon ...	Do. ...								Abolished.
	Padhegaon ...	Do. ...				0 12 0				

(a) Ruston Power crusher at the Kopargaon Farm earned Rs. 944-7-0 as hire charges.

Hire of Implements at Depots—contd.

Serial No.	Name of Depot.	Taluka.	District.	Hire collected during 1918-19.	Hire collected during 1919-20.	Hire collected during 1920-21.	Remarks.
				Rs. a. p.	Rs. a. p.	Rs. a. p.	
18	Gondavni ...	Kopargaon.	Pravara Canal, Ahmednagar.				
19	Kolhar ...	Rahuri ...		17 1 0	54 12 6	82 0 3	
	Ashwi ...	Sangamner.		0 3 0	18 9 0		Abolished.
20	Nasik ...	Nasik ...	Nasik ...	141 4 0	101 10 6	64 9 6	
21	Chandor ...	Chandor ...	Do. ...		100 14 0	124 8 0	
	Deola ...	Kalvan ...	Do. ...	168 13 0			Abolished.
22	Brahmangaon ...	Baglan ...	Girna Canal, Nasik.	161 15 6	158 6 0	199 1 6	
23	Ozar ...	Niphad ...	Kadva Canal, Nasik.	30 8 0	68 6 0	106 1 0	
24	Jalgaon (*a*) ...	Jalgaon ...	East Khandesh.	25 3 8	92 9 0	155 2 0	
25	Chalisgaon ...	Chalisgaon.	Do. ...	45 8 0	78 9 0	71 15 0	
26	Amalner ...	Amalner ...	Do. ...	15 0 0	42 10 0	69 4 0	
27	Dhulia ...	Dhulia ...	West Khandesh			10 12 0	
	Dhulia Farm ...	Do. ...	Do. ...	4 0 0	27 12 0		Abolished.
28	Ner ...	Do. ...	Panjra Canal, West Khandesh	11 0 0	29 9 0	18 10 0	
29	Nandurbar ...	Nandurbar.	West Khandesh	5 7 0	0 12 0	10 10 0	
30	Sindkheda ...	Sindkheda...	Do. ...	22 13 0	5 5 0	6 14 0	
	Shirpur ...	Shirpur ...	Do. ...	8 4 0			Abolished.
			Total ...	2,173 10 2	3,032 0 3	2,927 6 9	

(*a*) At the Jalgaon depot demand for implements being keen, plows belonging to Pachora Agricultural Association were given on hire from this depot which realized Rs. 266-12-0 as hire charges.

N.B.—Out of the above depots, seven are managed by Honorary Secretaries, one by Agricultural Association and the rest by the department.

The continued efforts of the Farm and district staff in bringing to the notice of the Khandesh cultivators the advantages of different sizes of iron plows for different purposes, (*viz.*, removing Hariali and Kunda and for uprooting cotton stalks) have at last induced the Khandesh cultivators, to take to the use of these plows. Mr. Vagholkar has done excellent work in this respect, as he has not only given a large number of plows on hire from his Farm, but has induced several Agricultural Associations to keep such plows for hire.

Demonstration Plots.—A large number of demonstration plots were organized temporarily by the district staff in cultivators' fields for demonstrating to the cultivators any particular departmental method. The cost regarding this particular method is borne by the department, the rest of the ordinary field operations being done by the owners of the plots. These plots have been of great use in popularizing our various methods of cultivation, in introducing new crops, new manures and new implements. Mr. Kogekar, the Divisional Superintendent, has been successful in introducting peas as Kharif crop in the Junnar taluka of Poona district. Mr. Athalye has taken up to introduce Red Mauritius variety of cane in the salt affected lands under the canal tracts. As a result of demonstrations in cultivators' fields in previous years, groundnut has now become a common crop in the two Khandesh districts. It is now grown in rotation with cotton on light and medium lands. The area under this crop in Khandesh districts has gone to such an extent that difficulty of labour is found at harvest time. Mr. Vagholkar is taking trials of various indigenous and foreign implements, to enable him to recommend to the cultivators the most suitable implement, for removing the nuts by bullock-power instead of by hand labour.

Special Work.—The special work undertaken by the department during the year was the management of Famine Cattle Camps and the management of the special fodder Farms under canal irrigation. Mr. Nikam assisted by Mr. Gadgil managed the Cattle Camps and Mr. Athalye, the Divisional Superintendent of Agriculture, Deccan Canals, assisted by his district staff managed all the operations of growing fodder on the two large areas at Kokamthana and at Khandala. The total area of these two Farms was over 600 acres.

The fodder scheme was undertaken at the instance of Rao Bahadur G. K. Chitale on behalf of the Famine Fund Committee. The main object of the scheme, was to grow and supply fodder to cattle camps which were intended to be opened within short distances of these Farms. The secondary object was to supply green fodder by special transport arrangements, to the more distressed talukas in the Ahmednagar district. But as both the original objects were not fulfilled for some or other reason, the scheme, though successful in raising large quantity of green fodder, and supplying nearly 4 lakhs of pounds to cultivators and others, at easy rates, did not serve its purpose as fully as it was expected. Besides the scheme was not a financial success, owing partly to the scarcity of water in the canal, which stunted the growth of the crop in its early stage and partly for the difficulties in the disposal of the late grown fodder.

From experience, during the current year in the Ahmednagar district and from that in the Satara district in the year 1918-19, in growing fodder for famine purposes under canal irrigation or by special lifts worked by oil engines, it can be definitely stated that such schemes are not successful, especially as it is found difficult to dispose off the fodder when ready. With any amount of pre-thought and arrangements, it takes sometime for Government Agency, to start such work, and the fodder thus grown is ready for sale at the time when other people, having irrigation facilities, have got their selfgrown fodder ready for use. Besides, by this time, cultivators dispose off their surplus and less useful animals, and are thus not in such urgent need of fodder as they seem to be when starting these schemes. Besides great difficulty is experienced in transporting large quantity of green fodder to long distances.

The success of growing fodder for famine use would, it is believed, be only achieved, when premanent schemes are started and large quantities of fodders grown under these schemes, are stored in good years for immediate use when famines occur.

Demonstrations and Shows.—In this year 5 demonstrations were held in the canal tract and 4 in the dry tract, those at Kopargaon and Jalgaon Farms, being on a larger scale than the rest and attended by parties of selected cultivators from different parts. Improved methods of cultivation of sugarcane, cotton, fruit trees were demonstrated and explained in lectures. Besides these, a large number of small demonstrations consisting of working of a single implement or a new method of cultivation were carried out.

Agricultural Associations.—There are 29 associations in the non-canal tract and 2 in the canal tract. Of the former 8 have engaged fieldmen to popularize improved methods recommended by the department. The Jalagaon Association having a large fund has a building of its own, and it held a cattle show during the year. The Pachora Association has a large stock of iron plows and makes a good business in hire. This association, with a commendable originality, has undertaken land improvements and economic survey of a village named Pardhada.

The Sirpur and Jamner Associations have maintained cattle breeding Farms and are contributing to the improvement of the breed in their localities.

In the canal tract Baramati Association has collected funds for pig killing campaign and is undertaking this operation on its own account.

Contribution to Agricultural Literature.—The following were the contributions during this year :—

1.	Mr. Kogekar, Divisional Superintendent of Agriculture, C. D.	A Leaflet each on Chaff Cutter, Reaper and Manuring Onions.
2.	Mr. Athalye, Divisional Superintendent of Agriculture, D. C.	3 Articles to the Shetki and Shetkari.
3.	Mr. Vagholkar, Superintendent, Jalgaon Farm.	1 Article to the Agricultural College Magazine.
4.	Bhandarkar, District Agricultural Overseer, Rahata.	5 Articles to Shetki and Shetkari.

Vernacular Agricultural School, Loni.—Since last year the management of this school is transferred to the Deputy Director of Agriculture; till then, from the time of its start in 1910, the school was under the direct charge of Dr. Mann, at whose original idea these Vernacular Agricultural Schools are started in this Presidency. There is no change in the staff of the school except that the Vernacular Agricultural Teacher is given privilege leave, combined with furlough, for 14 months. He is relieved by Mr. Derle, a third year trained teacher from the Educational Department. A permanent carpenter knowing smithy is employed during the year to give practical training to boys in carpentary and blacksmithy.

The initial difficulty of securing boys for the Vernacular Agricultural School seems to have overcome to a considerable degreee. During the year under report there were

70 applications for admittance, from various parts of the Deccan. Of these only 29 are admitted for the first year's course. The total number of boys in the school including of the 2nd year is 52 which exceeds the maximum limit.

Arranged according to districts, they stand as below:—

Serial No.	Name of District.	1st year No. of Students.	2nd year No. of Students.
1	Kurandwad State ...	0	2
2	Belgaum ...	1	1
3	Ratnagiri ...	0	1
4	Poona ...	2	2
5	Baroda State ...	0	1
6	Nasik ...	2	3
7	Nazam's State ...	0	1
8	East Khandesh ...	13	6
9	Phaltan State ...	1	1
10	Kolhapur State ...	1	1
11	Berars ...	0	1
12	Ahmednagar ...	6	2
13	Sangli State ...	2	0
14	Dharwar ...	1	0
15	Sholapur ...	0	1
		29	23

Arranged according to castes, they stand as below:—

Brahmins	...	19
Non-Brahmins	...	33

From the above it will be seen that a larger number of students are coming from the East Khandesh district; next comes the Ahmednagar district. It is not understood why Sholapur and Satara are not taking advantage of the school though they are the nearest districts to the school. It is hoped that the District Agricultural Staff in these districts will now find out suitable boys and send them to the school.

The course of study remains the same as in the last year. Usually boys are taken round on Saturday to visit neighbouring Government and private Farms of interest, where they gather information on various agricultural points, which are then discussed in the class on their return and explained by the Head Master when necessary. Besides these, weekly visits to local farms and gardens, the boys were taken on excursion, for over a fortnight, when they visited Belapur, Kopergaon and Jalagaon Farms in the Deccan, and Surat, Amalsad and Navasari in Gujarat.

Poultry breeding is taught as a secondary occupation in this school. It is intended to introduce weaving of carpets required for agricultural use, as it may be found more interesting to some of the boys.

The school receives some monetary help from the several District Local Boards. The amounts received from the several districts is given below:—

(1) West Khandesh	...	Rs.	72	0	0
(2) East Khandesh	...	,,	936	0	0
(3) Poona	...	,,	144	0	0
(4) Nasik	...	,,	288	0	0
(5) Sholapur	...	,,	360	0	0
(6) Ahmednagar	...	,,	180	0	0
Total	...Rs.		1,980	0	0

Visitors to the School.—The school is visited by several officials and non-officials and also by the parents of the students. Amongst the prominent visitors during the year, may be mentioned, the names of the Yuvaraj Maharaja of Kolhapur and the Chief of Savantwadi.

The Annual Examination was conducted by Mr. G. K. Ranade, Assistant Professor of Agriculture at the Poona Agricultural College and Mr. Jadhav, District Agricultural Overseer, Baramati on the Nira Canal. Out of 51, boys appeared for the examinations in the 1st and 2nd year, only one boy failed in the first year.

Establishment.—All the members of the staff with a few exceptions have performed their duties very satisfactorily. The success of growing fodder crops at Khandalla and Kokamthan for famine purpose, was mainly due to the hard work done by Mr. Athalye and his staff in addition to their own duties.

The transfer of Mr. Vagholkar from the Jalgaon Farm to the district cotton work has been the selection of a proper man to the proper work. Mr. Vagholkar possesses all the qualities required for district work especially in the cotton branch. His personal influence with cultivators and traders and his thorough experience in the cultivation of Khandesh cottons under different conditions, would, I am sure, enable him to organize the cotton scheme in a very popular and successful manner.

Messrs. Kogekar, Nikam and Gadgil have played their part well in successfully organizing Famine Cattle Camps at Kopergaon and Lakh.

The heavy amount of correspondence and account work as seen by me since I took charge of this office is very ably conducted by the Head Clerk Mr. Gharpure and his assistants for which they deserve credit.

M. L. KULKARNI,
Ag. Deputy Director of Agriculture,
C. D.

APPENDIX C.

Administrative Report, and Summary of Work by Deputy Director of Agriculture, Southern Division, Dharwar, 1920-1921.

(1) STAFF.

1. Mr. Gilbert was on leave from May 1st, 1920, to January 13th, 1921, during which time Rao Saheb M. L. Kulkarni again acted as Deputy Director. Mr. S. V. Shevade returned from one year's furlough on May 1st, 1920, and Mr. G. R. Deshpande who was in charge of the Dharwar Farm during his absence returned to the Gadag Farm. Mr. H. B. Kulkarni was thus relieved of superintendence of the Gadag Farm, and was appointed to one of the temporary special posts for cotton work, sanctioned under Government Order No. 11019, dated 18th October 1919, Revenue Department. Mr. T. S. Swadi, Superintendent, Gokak Canal Farm, was on deputation as Divisional Superintendent of Agriculture, Deccan Canals, for one month, and was on privilege leave for 1½ months. Mr. A. R. Neginhal acted in his place.

Messrs. Mutalik-desai, Gondhalekar and Byatnal are graduates who joined the department during the year.

Mr. R. K. Itigi was promoted to the status of graduate fieldman.

2. The department regrets to have to record the death of Mr. H. G. Kulkarni whose services are keenly missed.

(2) ORGANISATION.

3. The staff is organised in sections, each responsible through its head to the Deputy Director. These sections are three Farms, each managed by a Superintendent, a territorial division comprising Sholapur, Satara and Bijapur districts under a Divisional Superintendent, and another comprising Dharwar and Belgaum districts, under an Inspector. An Agricultural School, a Cotton Breeding Branch and a Cotton Propagandist Branch complete the enumeration of 8 sections. The Inspector's work exactly corresponds to that of a Divisional Superintendent, but his post is not gazetted.

4. The two cotton branches were temporary but have been made permanent since the year under report. The simultaneous organisations for propagandist work, one based on area, and the other based on a special crop are not convenient, a point which has been emphasised and explained in a special report on the cotton work.

5. The Tegur Cattle Farm is worthy of being added as a separate farm section instead of being included in the Inspector's section, but at present, the superior staff available are insufficient to make this Farm a graduate Superintendent's charge.

6. A move, prompted by the Director, is being made to organise research committees in consultation with specialists at Poona, for research on local problems relating to soils and plant diseases.

7. Advertisement amongst the public is effected personally, and on an increasing scale through the medium of Co-operative Unions, by Vernacular leaflets published at Headquarters, and by articles in a magazine published by the Dharwar District Agricultural Association. This magazine is in practice a departmental production, it very rarely receives a literary contribution from an unofficial member, it does not receive the support it should from the department's staff.

8. An Annual Conference of Heads of sections is held to discuss and co-ordinate the work.

(3) EXPENDITURE AND RECEIPTS.

9. Excluding transactions under the Director's Personal Ledger Account—

Name.	Expenditure.	Receipts.
	Rs.	Rs.
Dharwar Farm ...	22,449	7,568
Gokak Farm ...	17,337	14,600
Gadag Farm ...	6,199	1,764
Tegur Farm ...	4,523	467
Devi-hosur School ...	11,441	2,923
Agricultural Experiments other than at Experiment Stations.	6,650	1,794
Demonstrations ...	2,050	
Superintendence.		
Salaries ...	42,316	
Travelling Allowance ...	13,529	
Contingency ...	4,002	
Net Cost ...		1,01,380
Total ...	1,30,496	1,30,496

Balance sheets are not available for publication till after audit, but will show a portion of the net cost described above as material assests.

(4) Experimental Farms.

10. *Dharwar.*—The work on this station has undergone considerable revision during the last few years, and a summary of past and present work has been written as an accompaniment to the Superintendent's annual report for 1920-1921. The main features of the station are now :—Plant Breeding, especially cotton breeding; selected cotton seed production; comparative trials of new varieties offered by the Plant Breeding staff: an experiment which has been current since 1908 to determine the optimum amount of Farm manure to apply to black cotton soil; an experiment to determine how often black cotton soil needs deep ploughing, and a few experiments of minor importance; embanking against surface erosion; fruit-gardening especially for the production of mango grafts, seedlings of good varieties of plantains, and seedlings of other fruit trees; trial of cultural implements. An implement depot stocks implements for sale and keeps implements for hire on behalf of the Dharwar District Agricultural Association. A smithy and carpentry shop makes a few implements, experiments with adjustments of small machinery for local needs, and carries out repairs for cultivators and for the Farm. Newly imported implements are tried.

11. The past experimental work on artificial manures is a record of negative results, and though nitrates have paid in exceptional years the general rule at the station is that given a sufficiency of organic material in the soil, the rainfall will not generally allow crops to be increased profitably by readily soluble fertilisers. This conclusion need not apply to the wetter black soil tracts; in fact regarding nitrates there is evidence, though no proof as yet, to the contrary.

12. Cultural work has shown definitely that clean black cotton soil does not make a profitable response to deep ploughing with an iron plough every year, or every second year. Further work must determine how often or under what conditions deep ploughing is necessary. The cultivator rarely uses an iron plough except for dirty land. Many types of ploughs have been tested in the past, and a new ones often arrive for test. As a result of work at Dharwar and elsewhere in other divisions, the department demonstrates various makes, all of which have their good and bad points, and the customer has to make his own choice.

13. Work on crop rotations has also been negative, in so far as it has denied to many rotations tried, a prior place to the cultivators' practice of rotating cotton and Jowar mixed with pulses. Groundnut has however been shown to be a very useful crop to introduce as a third course, where labour is plentiful at harvest time, and where pigs are not troublesome.

14. Varietal trials, breeding and selection work, except in the case of cotton, have been disappointing. Cotton has always been under a specialist, and the material results of his work are that there are now many thousands of acres of improved cotton out in the district. For some reason, breeding of other plants has always been any man's job, and there is no doubt that this work too must be put on a pedigree basis under specialists. A start has been made in this direction with Jowar, and on a smaller scale with wheat.

15. The value of poudrette has been demonstrated, and the effects of a heavy dressing are manifest for several years. Cotton waste is good manure, and though results of experiment with this material cannot be of direct practical value, they are likely to contribute to the understanding of manurial requirements of black soil.

16. *Gadag.*—This Farm will be abandoned shortly, as soon the new cotton seed farm is established. Since 1908 the station has been mainly devoted to trial of Hirsutum types of cotton. Cambodia cotton was for a time expected to have very far reaching effects, but another cotton, Gadag No. 1, evolved from a selection from Dharwar American certainly ranks as an invaluable achievement, provided that success continues to attend organisation of sale and seed distribution.

17. Other experimental work on cultivation and varietal trials of Jowar, wheat and minor crops will be discussed in a special report when the station closes. The varietal trials indicate that it is worthwhile to import seed of a Rabi Jowar known as "Dagadi" from Sholapur, and red wheat from Bagewadi, but as the varieties dealt with were never pure, the value of this work is uncertain until investigated further with standardised, or pure line varieties.

18. *Gokak.*—This is an irrigated Farm of about 60 acres area. At present its main features are sugarcane culture, fruit-gardening and alkali land reclamation. A depot supplies implements and seed to cultivators.

19. The chief experimental work on sugarcane concerns planting systems and manures. A few short season varieties are under observation. A modification of the Manjri method of planting has given yields far in excess of the local method and an exceptionally heavy outturn of 39 tons netting Rs. 937 to the acre is a notable achievment in the Gokak Canal Tract. Groundnut and safflower cake manures are being compared, trash is being tried successfully as a substitute for half the usual quantity of Farm manure. The use of poudrette is demonstrated. San is being tried as a cover

crop to be dug in, against the ordinary method of green manuring. Cake and ammonium sulphate top-dressings are being tried on Jowar, Khapli, maize, chillies and turmeric. Farm manure prepared without special arrangement to collect urine is being compared with manure to which urine absorbed in earth has been added.

20. The Alkali Land Reclamation Scheme was laid out some years ago—the land was divided by open drains into small plots, and salts were washed through. It is now good paddy land, and in parts Jowar, Shevari, Ragi and sunflower did well. This work will form the subject of a special publication.

21. Amongst miscellaneous crops, onions for seed realised Rs. 323 per acre net. A small plot of Shevari was sold to a cultivator and realised Rs. 114. Dharwar No. 3 cotton gave a good outturn, but was weak in staple. Lucern does well. Sweet potatoes are a paying crop. Tobacco is receiving attention.

22. The fruit garden is 2¼ acres in area, and yielded Rs. 872 at a cost of Rs. 444. The profit works out at Rs. 190 per acre, but this figure is no guide to what can be done at places better situated for market. Pomegranates, Santras, guavas, figs, grape vines and plantains occupy most of the area. There are a few other indigenous and foreign fruit trees. With the exception of a few of the citrus trees that are attacked by anthracnose, the plantation looks extremely healthy.

23. Implements worth Rs. 3,500 and seed worth Rs. 800 were distributed from the Farm.

24. Visitors to the Farm, other than local cultivators numbered 600 cultivators, 40 students, and 20 Government servants. Sugarcane, fruit-garden and implements are the chief subjects of enquiry.

25. The Farm lends Gulvyas, Jalvyas and ploughmen to cultivators.

26. Lack of storage space for implements and for Gul is a great handicap.

27. *Tegur.*—Stock numbered 106 on the last day of the year. 2 cows and 7 calves died. 8 old cows and one calf were sold. A new Amrit Mahal Bull was purchased.

28. The Farm area is 371 acres, of which 6 acres are under Jowar cultivation, and a small area under paddy.

29. A good sample of hay was made by carting after very little drying in the field and by salting each load as it was put on the stack. Three pits were filled with green grass for silage.

30. The plantation of Marvel grass is being extended, and Anthistiria ciliata, Anthistiria imberbis, and Ischaemum sulcatum are being given extensive trial. An experiment has been laid out in consultation with the Economic Botanist to test the effect of burning, grazing and cutting on a pasture consisting mainly of spear grass. Cattle do not do well on hay and silage without concentrated food. This year they were almost without exception extremely weak at the end of the hot weather.

31. A good deal of capital has already been put into this Farm but not enough. An enclosing fence is essential to keep pig out so that fodder crops can be grown, and paddocks are essential for proper management of breeding and feeding.

32. A few sheep purchased locally and two ⅝ bred Merino rams are flourishing.

(5) Divisional Superintendent's and Inspector's Sections.

A. Sholapur, Satara and Bijapur (summarised from the Divisional Superintendent's Report).

33. Two overseers in each district work under the Divisional Superintendent. One graduate is stationed at Sholapur, one at Islampur, non-graduates are stationed at Koregaon, Mohol, Bijapur and Bagalkot. Mohol has a small Farm for production of Neglectum rosea seed. There is no experimental Farm in any of the three districts.

34. Demonstrations of ploughs, or of implements generally were held at 25 places The original programme was curtailed because of famine. Sales of implements from depots were insignificant, partly because of famine, partly because private enterprise has largely relieved the department of the necessity of retailing ploughs. Profit from hire of ploughs in Satara district is shown below :—

	Rs.	a.	p.		Rs.	a.	p.
Opening value ...	851	6	5	Hire realised ...	207	1	0
Net profit ...	179	12	7	Repairs ...	23	13	0
				Closing value ...	800	5	0
	1,031	3	0		1,031	3	0

and this again is a business which is being taken up largely privately and by Co-operative Societies.

35. Seed distributed from the depots was principally cotton, potato and wheat. There was also a smaller demand for San, Hundi Jowar, onion and lucern seed.

36. The depots now do only a small business in ammonium sulphate, again because private enterprise and co-operation have stepped in. Sholapur cultivators were assisted in obtaining supplies of oilseed cakes for manuring sugarcane, and Hundi Jowar. 750 packets of copper sulphate were sold for the prevention of Jowar smut.

Experimental Work.

37. Safflower oilcake for turmeric at Tasgaon and for chilies at Islampur gave very encouraging results. Superphosphate was tried for brinjals at Sholapur with indefinite result. Cake has been used by cultivators at Arjunsonda and at Pandharpur for Jowar, spelt wheat and maize.

38. Gadag No. 1 cotton was unsuccessful at Sholapur. N. Roseum cotton has fallen in price below the value of the local mixture, and as the same is true of this cotton elsewhere with reference to local cottons, it is probable that it should no longer be advertised. Ginger at Islampur did well enough on a small scale to encourage further trial. Lucerne was tried at Almatti, and did well in its first year. Tamarind seed as a food for cattle is probably good, and details regarding its preparation have been recounted in a separate note by the Divisional Superintendent. Potatoes, Wal, maize were planted in the Sina river bed, but the river dried out too soon for the crops to attain maturity. Lime-sulphur wash failed to check the leaf-curl disease of chilies at Mutigi and Talikoti.

39. The Sindewahi sugar-boiling furnace was found to be inferior to the Poona furnace. In a comparison of the Poona triple furnace and the Sholapur furnace with two pans, the former took $16\frac{5}{6}$ hours boiling to produce 1,663 pounds of Gul, the latter, $20\frac{4}{6}$ hours to produce 1,228 lbs.

Famine Work.

40. The staff occupied a good deal of their time in teaching the people how to use prickly pear as a fodder. Demonstrations were held in 21 villages. Of the three methods used for removal of thorns, kerosine stoves are not popular as they are expensive and easily get out of order. A furnace is a good large scale method. The small hand tool described in Bulletin No. 97 came to be extensively used by Mahars, who sold prepared fodder to cultivators. One member of the staff was attached to the office of the Deputy Director of Agriculture for Animal Breeding for famine work under his control.

General.

41. Applications received from cultivators relate more often than not to problems for a mechanical or civil engineer. Those relating to well-boring and water lifting are sent to the Agricultural Engineer. There is no organisation for meeting applications relating to construction of tals. The far-reaching results which must attend systematic organisation to meet the calls for advice under this head have been urged repeatedly. A very great deal could be done by appointing to the staff of the Deputy Director of Agriculture officers qualified to make surveys of catchment areas, and to calculate strength of banks. Organisation of dynamite supply for blasting wells needs attention.

42. As pointed above the necessity for the Agricultural Department to continue taking part in the implement business which it has pioneered in its various branches is now rapidly passing. Repair shops are an urgent need, for the initiation of which public funds might well be utilised.

B. Dharwar and Belgaum Districts (summarised from the Inspector's Report).

43. The staff is a graduate and a non-graduate fieldman in Dharwar district, the former stationed at Haveri, the latter at Dharwar, and a graduate fieldman at Belgaum. A Kamgar works with each.

Experimental Work.

44. Trial of ammonium sulphate on sugarcane was made at eight villages in the Mallad. Where water-supply is sufficient results are so positively in its favour, that its use can be recommended unhesitatingly except where irrigation water is only available at planting time. This confirms work done in previous years in the Belgaum district, where ammonium sulphate is now in keen demand. Outside the Mallad, ammonium sulphate needs further attention in Hukeri taluka.

45. Safflower cake, 400 lbs. per acre was given to paddy at six villages in Dharwar district and at four in Belgaum. Yields were only measured in one instance, but in 7 cases out of the 10, the superiority of the manured crop was very distinct. In the other 3 cases excessive flow of water through the fields apparently carried the manure with it.

46. Nitrate of soda, mixed with earth, and sown behind the cotton drill has given promising indications at Harobelvadi. Other manurial experiments whose results are as yet indefinite are safflower cake for chilies, and a special tobacco manure at Akol, Chikodi, and a special experiment on betelvines.

47. Surface drainage of fields growing sugarcane after paddy at Kittur and at Devihosur, which was laid out 3 years ago, has improved the land considerably. Channels are dug along the margin of the field to carry away water which otherwise stagnates.

48. Comparison of cane varieties is in progress at Kambarganvi and at Benkanhalli.

Demonstrations.

49. Rice ploughs, various heavy ploughs, chaff cutters, wheat threshers, Poona sugar-furances, Nahan sugar mills and a small power cane-crusher were shown at work at appropriate places for each. These demonstrations numbered 42, were followed by lectures and where suitable by demonstrations of steeping Jowar in copper sulphate. The places appointed were in seven cases Co-operative Union centres, and were often places where experimental work mentioned above was in progress.

50. In addition to the above, demonstrations of garden hand tools, of the Surat cotton drill, and of the Gujarat Karab for uprooting cotton stalks were held in 9 villages in the Dharwar district.

Depots.

51. The Belgaum depot distributed Rs. 18,000 worth of implements including 10 tons of ammonium sulphate and manures and the balance sheet shows a profit of Rs. 946-14-0.

52. The use of concentrated manures is spreading rapidly in Belgaum, and records are to hand of distribution, other than by the Agricultural Department, of 16¼ tons mixed groundnut and safflower cake, 42 tons of ground cakes, 4 tons of fish manure, 5 tons of bone meal, and one ton of denaturalised salt.

53. Potato, knolkhol, cabbage seeds and sugarcane sets were also distributed. 900 packets of copper sulphate were sold.

54. *Agricultural Associations* are reputed to exist at Dharwar, Belgaum, Athani, Saundatti, Chikodi, but only those at Athani and Saundatti seem to be doing any independent work. Registered Co-operative Manure Supply Societies at Bellad-bagewadi and Kabbur, an Implement Society at Hosritti, and a Seed Supply Society at Devi-hosur were helped with their work.

Special Studies.

55. Tobacco cultivation, curing and marketting, cattle breeding in the Mallad, Jowar varieties, cane cultivation in the Mallad, grass varieties in the Mallad are subjects which are being investigated by enquiry and observation. A good deal of attention is being paid to fruit cultivation. The general remarks at para. 41 apply here.

56. The department owes a debt of thanks to various gentlemen who went to a great deal of trouble, and considerable expenditure for entertainment, on the occasions of some of the larger demonstrations.

(6) COTTON.

57. The organization for cotton work has been described in a special report, and details of the work are recorded by the Cotton Breeder, and by the Cotton Superintendent in their reports. Briefly the Cotton Breeder is responsible for research by selection and cross fertilisation, and for production of pedigree strains of cotton of varieties approved for distribution. He has provided pure seed of two strains this year, and will add a third in future. He has in hand a very interesting cross between G. herbaceum and Neglectum rosea, which is now in its 3rd generation.

58. The seed for distribution is multiplied on the Experimental Farms, and further amongst seed-growers. It passes from the Cotton Breeder's to the Cotton Superintendent's supervision, and he is responsible for controlling as a minimum sufficient seed to sow 5,000 acres.

59. Seed of Dharwar No. 1 from the Dharwar Farm was grown on 536 acres, seed of Gadag No. 1 from Dharwar and Gadag Farms on 74 acres and seed of Dharwar No. 3 from Gokak Farm on 335 acres. Pure seed of the three types available for distribution by societies and by the department this year amounts to—

		lbs.
Gadag No. 1	...	216,732
Dharwar No. 1	...	168,300
Dharwar No. 3	...	56,000

60. Elaborate comparison of Dharwar No. 1 and local Kumpta cottons was made at 10 places. In each case the varieties were compared on 5 pairs of plots of 2 gunthas. In three places, Unkal, Navalgund and Alur, Dharwar No. 1 was not as good as local cotton, in all other places better, and there is no question that there is a wide field for this cotton.

61. 2,300 dokras of Dharwar No. 1 and 2,300 of Dharwar No. 3 and 9,500 of Gadag No. 1 cottons came into the markets, and the large majority was sold through Co-operative Societies. The Cotton Superintendent estimates the extra profit to growers of these cottons at Rs. 1,12,700. Co-operative Sale Societies are increasing in number, and are holding more sales every year. It is high time that the well established societies trained their own graders. The Agricultural Department's staff will not be able to cope with the grading work as societies' activities expand.

(7) Devi-hosur School.

62. 12 students attended the first year course and 13, the second. 10 were Lingayats, 12 Brahmins, 1 Maratha and 2 Nadors. Three failed in the final examination.

63. The expenditure of the school was Rs. 11,441 or Rs. 458 per boy. Against this expenditure there were receipts of Rs. 2,923.

64. The school aims at giving boys a practical training throughout, and in addition to farming classes, holds classes in carpentry, smith's work, and weaving.

65. The chief difficulty with which the school has to contend is the fact that a long interval lapses between the time when a boy passes his fifth or sixth vernacular standard and the time when he is of an age fit to start his agricultural training. It is a difficulty which seems insurmountable.

(8) General.

66. I have made this report entirely impersonal, as I have had a few months in touch with the staff since 1916, and do not care to make special mention of any one officer's work. The work described is partly directed and co-ordinated from head-quarters, and is partly done independently by members of the staff.

67. I will close by mentioning a few items which need attention in future, in addition to the development of the work described.

68. The Southern Division grows a large area of paddy—there is a big field of work on varieties and on cultivation which is yet untouched, and which needs an Experimental Farm.

69. Experiment stations are handicapped by having no provision to entertain visitors. They need hostels to enable them to do what any cultivator would do for a visitor.

70. Systematic embankment against surface erosion is a crying need of the country, and the department wants a special staff to cope with this work. It is a field where a little engineering knowledge, and an ordinary allowance of common sense could produce very far reaching results, and it is a great pity to leave such a promising field untouched for want of a comparatively small outlay on staff and equipment.

T. GILBERT,

Deputy Director of Agriculture,
S. D., Dharwar.

APPENDIX D.

Work done under the Deputy Director of Agriculture, Gujarat Division, in 1920-21.

Staff.

I was in charge of this Division throughout the year.

Mr. G. N. Desai worked as Divisional Superintendent of Agriculture, N. D., and Mr. K. D. Naik as Cotton Superintendent on the temporary establishment, for the whole year.

Graduate Assistants available for responsible work in the Division are located as under:—

Cotton Supervisor, with one assistant (temporary)	...	2
On Experimental Stations	...	5
For Entomological work	...	1
For propagandistic work in the district	...	3*
Vernacular Agricultural School	...	1
Temporary Graduate Assistants under the Cotton Superintendent	...	3
Graduates in training	...	3
Total	...	18

*As the services of senior men have been lent to States, &c., the staff for the district work is below the sanctioned strength. Thus, three posts remained vacant as no graduates were available to fill the vacancies. But as new posts have been sanctioned and as the required number of new graduates have been secured from this year's new batch, it will be possible to meet the increased demands as soon as these new recruits get trained to their work.

Besides these there were 10 non-graduate fieldmen (including one under training), four Kamgars and several depot-keepers and ploughmen engaged for demonstration purposes.

2. The season on the whole was unfavourable for the greater portion of the Division except for the Surat District where it may be said to be fairly good on an average.

3. *Experimental Farms and Sub-Stations.*—These were the same as those reported last year except that the work at the Sunev Kela Plot was discontinued by the end of the year under report as per Government Order No. 232, dated 25th January 1921.

4. In addition to the usual experimental and demonstrational work on the Experimental Stations and Sub-stations, the most important work in the Division consisted in improving the cotton strains of different varieties of Herbaceum cottons and their distribution on a large scale in the district. This is detailed as under.

Cotton Breeding Branch.

5. On the *Surat Farm*, for the first time, the whole area under cotton was sown with the seed propagated from a single plant, *viz.*, Selection I-A, Long Boll Type. The seed goes for the Farm sowing in the third generation after it is raised from protected flowers. In these generations, conservative selection is continued. This year on the whole Farm area, the rogues were marked out, whose percentage was 2·6. This was done with a view that the seed to be distributed in the first group of villages should be quite pure and should require the least amount of roguing. The plants of this type can be definitely recognised after they have well developed bolls. This strain and the unit strain of 1027 A. L. F. were compared against the local in separate plots, with the following results:—

Variety of Cotton.	Yield per acre in lbs.	Ginning Percentage.
Surti Deshi ...	645½	35·3
Selection I-A, Long Boll Type ...	765	37·9
1027 A. L. F. ...	734¾	36·1

When they are tried in alternate rows, the results are as under:—

Variety of cotton.	Standardized Yield in lbs. per acre of		Valuations by Cotton Contracts Board per Khandi of 784 lbs.	Value of		Gross profit per acre in Rs.
	Seed cotton.	Lint.		Lint as per valuations.	Seed at Rs. 2 per lb.	
Surti Deshi ...	867	308·6	310	122·02	27·91	149·93
1027 A. L. F. (Surat Farm)...	962	353·0	335	150·83	30·45	181·28
Selection I-A, Long Boll Type.	898·9	352·3	340	152·78	27·33	180·11

1027 A. L. F. grown in Navsari tract was valued at Rs. 325 per Khandi, while Navsari Deshi from the same tract was valued at Rs. 315.

From this, it will be seen that it is very advantageous to grow Selection I-A Long Boll Type and 1027 A. L. F. cottons.

1027 A. L. F. grown at Surat is superior to that grown in Navsari tract. This has been already observed in previous years and it indicates the necessity of acclimatising this type by selection in the Navsari tract (*vide* page 29 of the last year's report).

6. The unit strain of 1027 A. L. F. was distributed on Navsari side. It was sown this year on 27 acres and was reported to be uniform. On account of the small area it was not separately sold, but it was considered by the merchants to be superior to the original 1027 A. L. F. and more so than the Navsari local. It will be possible to sow 4,000 acres with this strain in the year 1922-23.

7. Unit selection in two strains of local cotton, two of Selection I-A, one of Selection II four of 1027 A. L. F. and one of 1018 P. G. was continued. All these strains are maintained as each of them has directly or indirectly useful characters which may either be useful in this or any other tract for further propagation or crossing.

8. Investigation of the causes of the low yielding capacity of the indigenous cottons in comparison with the exotics in their own home was carried out under the following main heads:—

(*a*) The physiological—such as cloudy weather, variations in climatic conditions;

(*b*) Botantical—such as the hereditary character, manner of growth, shedding of flower buds and flowers, normal fertilizing power, ripening habit, &c.

(*c*) Entomological—such as boll worm attack.

All preliminary observations indicate that the heavy rains and the attack of boll worm cause a huge shedding of flower-buds which is absent in the exotic cottons. This factor having been determined, as it is the main reason of the low yielding capacity of our cottons, the characters of the plant which give some immunity to boll worm are being investigated.

With a view to have a strain superior to any yet discovered, the crosses between pure-bred strains made last year had reached the F1 generation, and the characters have been critically observed for working out these crosses on Mendelian lines in future generations.

9. On the *Broach Farm,* five pure strains of Goghari are now maintained with a view that any of them will be useful for cross fertilization work owing to the special economic characters of each of them, though all of them as they are have an inferior staple and hence are of little importance. One more strain of Goghari with high ginning percentage and good staple is maintained. It is rather deficient in strength of fibre and selection is continued with a view to obtain all the economic characters in it. This strain was kindly valued by the Cotton Contracts Board at Rs. 325 per Khandi when pure Broach-Deshi was valued at Rs. 330. From this, it will be seen that this is the only strain of Goghari in which good staple and high ginning percentage of lint are combined.

Last year 8 plants were selected individually out of pure Broach-Deshi with a view to segregate a strain having all desirable characters in case the Selection I-A from Surat Farm transferred here does not show the improved characters to the same degree. Out of these, only four have been maintained; one of these though not equal to Selection I-A in point of staple, seems to be uniform and will be tested for yield against it.

From the Surat Farm, Selection I-A Cylindrical Boll type reputed to be of the bushiest type and heavy yielder was transferred to Broach and the whole Broach Farm was sown with this variety. This was tested with the local cotton with the following results:—

Variety of cotton.	Yield in lbs. per acre of		Valuations by Cotton Contracts Board per Khandi of 784 lbs.	Value of		Gross profit per acre in Rs.
	Seed cotton.	Lint.		Lint as per valuations.	Seed at Rs. 2 per 40 lbs.	
Purified Broach-Deshi ...	296·5	108·0	330	45·78	9·38	55·1
Selection I-A, Cylindrical Boll Type.	318·0	115·1	325	47·7	10·14	57·8

It should be noted that this purified Broach-Deshi contains no Goghari plants, while the cotton which is grown in Broach district is nothing else but Goghari and is very inferior almost like Khandesh cotton.

Selection I-A, Cylindrical Boll Type is meant for the whole of North Gujarat beyond the north of the Nerbudda. Owing to the change in the market conditions there is a great demand of pure seed of long stapled cotton and the seed of this type from the Broach and Surat Farms is being distributed.

11. *Ahmedabad Cottons.*—As there is no Government Farm, the segregation of these cottons is continued on the Broach Farm. 3 strains of Lalio and 8 of Wagad are maintained for unit selection. Out of these strains two of Lalio and 5 of Wagad are worth trial in their original locality to test their importance, as they possess definite characters and are uniform and promising. Out of these, Wagad Plant 4 is the best in point of staple, while Plant 12 is the best in point of yield.

These strains of Lalio and Wagad will now be transferred to their home in Ahmedabad district at Sanand where an area of 12 acres has been hired for continuing the breeding work for Dholera tract.

12. On the *Dohad Farm,* cotton experiments are being conducted since long and as a result, it has been discovered that only the Khandesh cotton which ripens early can be successfully grown and economically taken up by the cultivators owing to the prevalence of frost in the last week of December.

An early ripening type was segregated on the Surat Farm, and a small quantity of the seed that was available last year was tried at Dohad. It has maintained an early ripening habit so much so that it finished flowering by the middle of November and all the bolls had fully formed by the second fortnight of December. The first heavy picking was also obtained by the 3rd week of December, *i.e.*, before the usual time of the appearance of frost.

This was kindly valued by the Cotton Contracts Board at Rs. 315 per Khandi, when N. R. cotton was valued at Rs. 230 which it is intended to replace.

13. In addition to the Breeding work on the Farms, the Cotton Supervisor undertook the training of two graduates from the Baroda State Agricultural Department.

Mr. M. L. Patel, Cotton Supervisor, has put in hard and sincere work in his branch.

District Cotton Work.

14. There has been no change in the settled policy of district cotton work except that nearly 7,231 acres instead of 6,000 acres were under departmental control.

As people from five more villages round about the Farm were pressing so much long since for being included in the groups, one more group was formed with clear understanding that the group will be kept quite separate from the rest. Thus, instead of five, there were six groups in all, with a total area of 7,231 acres; of which 4,920 acres 31 gunthas were sown with Selection I-A and the rest with 1027 A. L. F. In addition to the above, 24 acres were under 1,027 A. L. F. unit strain which is finally intended to be increased and given to the whole Navsari tract. In the absence of a Farm in the Navsari tract, Mr. Jinabhai Devabhai of Vijalpur has helped the department much in multiplying the seed from 100 lbs. given to him in 1918 to its present stage.

15. *Season.*—It was normal in the commencement and no difficulty was felt in establishing the crop except in the Mohni group where a second sowing was required to be done. On the whole the crop progressed well everywhere till September when much anxiety was felt owing to want of rains. The late September rain was not even in all the

groups and the resulting produce differed in quality in proportion to this rain. There were no insect or Fungoid pests of importance during the year. Owing to short rains the crop matured early. The staple produced was good in class but rather coarse and short. The picking commenced in the middle of January, the harvest being over by the end of March.

16. *Collection of Cotton and its Final Disposal.*—During the year under report only two meetings of the Cotton Committee were held as under:—

Date of holding.	Work done.
26th October 1920.	Putting before the Committee the annual report of work done during the past season and moving of certain resolutions in connection with the amelioration of Surat and Navsari cottons. The Director of Agriculture, Mr. Keatinge, was present at this meeting.
16th January 1921.	Fixing the rates of ginning, &c.

The other meetings were for the auction sale of the lint only and hence are not shown separately. A statement showing the auction sales held is attached herewith:—

Auction Sales.

Date.	Name of Group.	Quantity auctioned in Khandis.	Name of Purchaser.	Per Khandi.			Variety of cotton sold.	Remarks.
				Rate obtained.	Local rate.	Premium obtained.		
5-2-21	Sisodra ...	97	Messrs. N. F. Tamboli & Co. for Tata & Sons.	396	326	70	1027 A. L. F.	
„	Vijalpur ...	28	Do. do. ...	396	326	70	Do.	
„	Bardoli Group ...	95	Do. do. ...	370	311	59	Sel. I. A.	
2-3-21	Sisodra ...	60	Sheth Gangjibhai P. for Indore Malwa Mills.	355	315	40	1027 A. L. F.	
„	Vijalpur ...	42	Do. do. ...	359	315	44	Do.	
„	Bardoli ...	60	Mr. J. N. Kapadia for Chimobhai Madhavbhai Mills.	345¼	300	45¼	Sel. I. A.	
„	Do. ...	55	Mr. Keshavlal Dalshukhbhai for Ujjain Mills.	345¼	300	45¼	Do.	
2-4-21	Athwa Group ...	50	Mr. Jayantilal Thakorlal for Hindustan Mills, Bombay.	346	325	21	Do.	
„	Do. ...	115	Mr. Dahyabhai Sunderji for Hatim Mills, Surat.	346	325	21	Do.	
„	Moni ...	65	Messrs. N. F. Tamboli & Co. for Messrs. Tata & Sons.	346	325	21	Do.	
„	Sania Group ...	120	Mr. J. N. Kapadia for Hindustan Mills.	345	325	20	Do.	
„	Athwa Group ...	56	Do. do. ...	345	325	20	Do.	
„	Vijalpur Group ...	25	Messrs. N. F. Tamboli & Co. for Messrs. Tata & Sons.	416	370	46	1027 A. L. F.	
„	Supa ...	80	Do. do. ...	416	370	46	Do.	
„	Sisodra ...	55	Sheth Gangjibhai P. for Indore Malwa Mills.	415	370	45	Do.	
9-4-21	Moni ...	85	Sheth Keshavlal Dalshukhbhai for Ujjain Mills.	329¼	320	9¼	Sel. I. A.	
16-4-21	Bardoli ...	55	Messrs. N. R. & Co.	393	350	43	Sel. I. A.	
	Total ...	1,143						

Last year we auctioned about 550 Khandis. The produce of the current season is, therefore, nearly double of that. This is partly due to increased area, but chiefly due to better outturn.

A statement showing the quantity of cotton, lint, value of seed and lint realised, premium obtained, &c., is attached.

Statement showing the Details of Cotton, Lint and Seed, &c., during the Year 1920-21.

Serial No.	Name of the group.	Area.	Quantity of Seed Cotton received and ginned.	Quantity of lint obtained.	Quantity of seed obtained.	Rate per candy of improved Cotton one khandy 21 mds.	Rate of Local Cotton per khandy.	Value of Lint.	Value of Seed.	Total value.	Ginning charges, &c.	Net value.	Reduced rate per bhar.	Local rate per bhar.	P. C. increase over local rate.	Quantity of kapas required to get one khandy of lint of 21 mds.	Ginning percentage.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Acres. g.	Mds. ser.	Mds. ser.	Mds. ser.	K. m. s. Rs. a. p.		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.				
Section I. A.	Athwa Group— Athwa Bhatar, &c.	1, 31 25	12,847 37	4,895 29½	7,872	102½ 1½ 9½ @ 345 0 0 115½ 1 4½ „ 346 0 0 15 3½ 2 „ 355 0 0 0 2½ 0 „ 346½ 0 0	323 325 315 Lint for samples.	80,291 6 9	12,243 7 3	92,534 14 0	4,459 0	88,075 14 0	164 0 0	141 0 0	16·3	55·11	38·1	
	2 Sania Group— Sania.	354 13	3,482 32	1,242 2	2,218	56½ 2½ 6½ „ 345 0 0 2 0 „ 325 0 0	325 325	20,181 7 0	3,548 12 9	23,730 3 9	1,218 10 0	22,511 9 9	155 2 0	141 0 0	10·0	58·8	35·7	
	Parvat Abha, &c	520 33	3,806 29	1,386 1	2,485½	69½ 4½ 7 „ 345 0 0 2½ 0 0 „ 325 0 0	325 325	22,520½ 0	3,886 4 0	26,407 1 0	1,334 0 6	25,073 0 6	154 2 0	141 0 0	9·3	59·0 4	35·5	
	3 Moni Group	994 20	3,538 25 5,515 0	1,314 22 1,923 0	2,202 3,525	62½ 1 17³⁄₄₀ „ 346 0 0 91½ 1½ 8 „ 329 4 0	325 320	21,470 8 0 29,894 9 3	3,303 0 0 5,640 0 0	24,773 8 0 35,534 9 3	1,307 15 3 1,990 0 0	23,465 8 9 33,544 9 3	159 2 0 146 3 0	141 0 0 131 0 0	12·8 11·6	6 59·0	37·3 35·6	
1027 A. L. F.	4 Abrama	36 12	552 16	195 7	353	9½ 3 1½ „ 359 0 0	315	3,334 14 2	564 12 9	3,899 10 11	210 1 9	3,689 10 2	160 6 0	135 0 0	18·8	59·4	35·3	
	5 Sisorda Special.	780 24 16 0	2,861 7 4,581 9 200 26	967 35 1,623 26 65 22	1,845 3,000 130	46 1½ 6½ „ 396 0 0 47½ 3 8½ „ 415 0 0 30 0 0 „ 355 0 0 3 2 22 „ 416 0 0 0 2½ 0 „ 420 0 0	331 370 315 370	18,114 4 0 30,089 3 0 1,351 0	2,767 8 0 4,800 0 0 216 10 8	20,881 12 0 34,889 3 0 1,567 11 2	977 5 5 1,564 14 6 68 8 4	19,904 6 7 33,324 4 6 1,499 2 10	168 8 7 174 3 6 179 5 0	147 0 0 135 0 0 162 0 0	16·7 29·05 10·7	62·0 59·25 61·8	33·9 35·4 33·9	*This does not include 100 lbs. of lint sent to Bombay for valuation.
	6 Supa	1,050 26	3,054 19 6,772 31	1,069 0 2,234 21	1,950 4,560	50½ 2½ 5½ „ 396 0 0 30 2½ 8½ „ 355 0 0 76 4½ 9½ „ 416 0 0	331 315 370	20,005 0 0 42,144 12 0	2,925 0 0 7,206 0 0	22,930 0 0 49,440 12	1,043 6 0 2,313 13 0	21,886 10 0 47,126 15 0	171 15 4 166 14 0	147 9 0 135 0 0 162 0 0	16·3 23·6 3·0	60·0 63·7	35·0 32·9	
	7 Vijalpore.	278 3	3,317 23	1,135 28	2,167 20	21½ 1 8 „ 359 0 0 16½ 3½ 2½ „ 396 0 0 15½ 3½ 8 „ 416 0 0	315 331 370	20,921 11 0	3,405 0 0	24,326 11 0	1,242 8 0	23,084 3 0	167 0 0	135 0 0 147 0 0 162 0 0	23·6 13·6 3·08	61·3	34·2	
1027 Special.	8 Bhuvasan.	361 18	1,286 38 1,926 0 1,013 5	461 18 640 20 340 22½	774 1,980	21³⁄₄ 4 0 „ 370 0 0 30½ 0 0 „ 345 4 0 16 4½ 3½ „ 393 0 0	311 300 350	8,121 8 0 10,530 2 0 6,37 0	1,161 0 0 3,168 0 0	9,282 8 0 13,698 2 0 6,373 0 0	481 0 6 731 8 0 397 10 3	8,801 7 6 12,966 10 0 5,975 5 9	165 5 0 147 7 0 166 12 0	130 0 0 121 0 0 145 0 0	22·8 17·0 15·0	58·5 63·1 62·4	35·1 33·2 33·6	
	Babla.	0 15	833 28 1,026 0 711 5	303 25 341 10 240 26	513 684 30 470 10	14½ 4 ½ „ 370 0 0 16½ 0 0 „ 345 4 0 11½ 4 2 „ 393 0 0	311 300 350	5,346 5,610 5 0 4,500 13 10½	769 8 0 1,095 9 7 752 6 5	6,116 1 9 6,705 14 7 5,253 4 3½	309 9 1 390 3 2 280 4 9	5,806 8 8 6,315 11 5 4,972 15 6½	167 11 0 147 7 0 167 9 0	130 0 0 121 0 0 145 0 0	24·2 17·0 15·4	57·6 63·1 62·05	36·4 33·2 33·8	
	Nizar.	750 29	2,452 29 3,000 0 1,462 11	870 8½ 1,071 0 504 22	1,566 1,900 957 10	41½ 3 0 „ 370 0 0 51 0 0 „ 345 4 0 24 0 22 „ 393 0 0	311 300 350	15,381 14 0 17,607 12 0 9,413 12 0	2,349 0 0 3,040 0 0 1,531 9 9	17,680 14 0 20,647 12 0 10,975 5 9	953 0 8 1,166 4 0 568 4 0	16,727 13 4 19,481 8 0 10,407 1 9	163 11 0 155 15 6 170 9 0	130 0 0 121 0 0 145 0 0	21·2 23·8 17·6	59·1 58·8 60·8	35·5 35·7 34·5	
	Lakhanpore	326 38	1,102 2 1,128 0 703 3	382 34 383 10 226 36	712 737 470	18 4 16 „ 370 0 0 18½ 0 0 „ 345 4 0 10¾ 3 6 „ 393 0 0	311 300 350	6,741 6 6 6,300 13 0 4,242 7 3	1,068 0 0 1,179 3 2 752 0 0	7,809 6 6 7,480 0 2 4,994 7 3	409 1 7 428 11 5½ 275 12 8	7,400 4 11 7,051 4 8½ 4,718 10 7	161 3 0 150 0 0 161 1 0	130 0 0 121 0 0 145 0 0	19·4 23·1 11·08	60·4 61·8 64·1	34·7 33·9 32·7	
	9 Ancheli.	164 23	722 19 1,096 38	246 37 359 16	471 729	11¾ 0 1 „ 396 0 0 6 3½ 5 „ 416 0 0 10¾ 3½ 6 „ 359 0 0	331 370 315	11,146 14 0	706 8 0 1,166 6 3	13,019 12 3	681 4 0	12,338 8 3	162 0 0	147 0 0 162 0 0 135 0 0	10·2 20·0	61·6 64·1	34·1 32·7	
	Grand Total	7,254 39	69,085 32	24,425 38½	44,271 30			4,21,616 14 ½	69,335 10 7	4,90,952 8 7½	24,802 12 10½	4,66,149 11 9						

From the statement the following observations are worth making :—

(1) The average outturn of seed cotton comes to 382 lbs. per acre as against the average of 631 lbs. on the Surat Farm. The average yield of 1027 A. L. F. was 398 lbs. per acre, while that of Selection I-A was 369 lbs. It should be noted that these figures cannot be compared among themselves, as the locality of both the types has got much variation. The former was sown in the Jalalpur taluka, while the latter in Chorashi and Bardoli talukas. The figures may, therefore, be read in their true light.

(2) The minimum ginning percentage of Selection I-A was worked out to be 33·8 per cent. and the maximum 38·1 per cent., while for 1027 A. L. F. the minimum was 33·0 per cent. and the maximum 35·6 per cent. The ginning percentage varies much with locality, while less with variety. The Bardoli Group Selection I-A did not give any advantage in ginning percentage over 1027 A. L. F. of the Sisodra and Navsari groups.

(3) The premium obtained over Selection I-A in favour of 1027 A. L. F. stood as under :—

Auction.	Preminm for 1027 A.L.F.	Premium for Selection I-A.	Remarks.
I ...	70	59	Compared with Bardoli Selection I-A.
II ...	46	21	Compared with Surat Selection I-A.
Average ...	58	40	

The average premium of Rs. 58 per Khandi in case of 1027 A. L. F. and Rs. 40, in the case of Selection I-A may be considered as satisfactory. But the general tendency of the trade seems to be on the side of 1027 A. L. F., as in all the auctions there was keen competition for it; while there were few bidders for Selection I-A. If this tendency is continued by the trade, the department will soon have to consider putting out only one strain in the district with longer fibre, &c.

(4) The premia obtained for Bardoli Selection I-A and 1027 A. L. F. must be considered fairly satisfactory. But it was rather discouraging in the case of Surat Selection I-A, although for the Athwa group the higher ginning percentage compensated the low values obtained. Our Mohni group produces better staple and usually the Kapas (seed cotton) of this locality is sold as Vesma, Maroli and even as Navsari cottons. For sake of convenience this group gets its cotton ginned at Surat. The present market assigns importance to the ginning factory and not to the actual quality. It was therefore a discouraging feature for our Athwa and specially Mohni and Sania groups. Ordinarily these groups should obtain premium over Vesma-Maroli district prevailing rates. I, therefore, venture to suggest that these groups should be placed in a more advantageous position than before, by getting their cotton ginned in the Vesma-Maroli gins. This will be according to their rights as per prevailing practice.

The following gins were selected by the ryots in consultation with the Director of Agriculture, Bombay Presidency :—

Place.	Name of Ginning Factory.	Quantity of cotton ginned. Maunds Srs.	Name of groups for which the gin was selected.
1. Navsari ...	Tata Gin ...	22,334 17	Vijalpur, Barodli and Ancheli-Abrama.
2. Sisodra ...	Messrs. Dayabhai Ukabhai & Co.	17,470 12	Supa and Sisodra.
3. Sania ...	Messrs. Narandas Rajaram & Co.	3,538 25	Mohni.
		5,575 0	Khambhasla B and Kharvasa.
4. Surat ...	Kapadia Gin ...	12,847 37	Athwa group.
5. Do. ...	Bamanshaw Gin ...	7,379 21	Sania and Navagam.
	Total ...	69,085 32	=2,878-5 Bhars (approximately).

As usual, the owners of the gins selected for ginning have to make advances at 6 per cent. interest to the cultivators after November when the crop is fully established. The

amounts of the advances thus given in each group by different gin-owners are noted below:—

Names of Gin-owners.	Advanced amount.	Name of group.
	Rs. a. p.	
Sheth Jamshedji Navroji Kapadia, Surat ...	21,275 0 0	Athwa group.
„ N. F. Tamboli, Navsari ...	17,650 0 0	Bardoli and Vijalpur.
„ Bamanshah J., Surat ...	9,925 0 0	Sania, Navagam.
„ Dahyabhai S. Desai, Sisodra ...	9,400 0 0	Supa and Sisodra.
Messrs. Narandas Rajaram & Co., Surat ...	7,975 0 0	Mohni.
Total ...	66,225 0 0	

This practice is in vogue for several years past without any kind of defaults or complaints as regards the recoveries of the amounts advanced.

Thanks are therefore due to all the members of the Cotton Committee and the gin-owners who gave necessary facilities for keeping the seed unmixed with the local cottons and ginning the seed cotton in time and for giving advances at 6 per cent. when they had to pay 9 per cent. to 12 per cent. interest.

17. *Seed Distribution for the year 1921-22.*—The total quantity of seed obtained from the produce handled by the department came to 44,659 maunds, 33¾ seers or 1,786,399 lbs. which was all secured by the department for general distribution. The following centres were opened to distribute the seed:—

1. Navsari Tata Gin (Afterwards Vijalpur).
2. Surat Kapadia Gin.
3. Sisodra Gin.
4. Surat Bamanshaw Gin.
5. Bardoli Depot.
6. Madhi Depot.
7. Sayan Depot.
8. Kim Depot.
9. Sachin-Pardi Depot.
10. Sania Depot.
11. Surat Farm Depot.
12. Vedchha.
13. Ankleshwar.

The first 11 were managed by the Cotton Superintendent and the 12th and the 13th were solely looked after by Sheth Dayabhai Sundarji and the Mamlatdar of Ankleshwar respectively, the seed being supplied by the department.

The total quantity of seed distributed up to date including the quantity 18,000 lbs. produced from the Farm area and distributed in the Athwa group comes to 1,744,399 lbs., the remainder being reserved for resowings.

For this seed transaction, the total amount of Rs. 72,000 was drawn from the Personal Ledger Account Advance of Rs. 1,00,000 of the Director of Agriculture, and after defraying the incidental cost of maintaining depots and depot-keepers, &c., the net profit realized by Government will approximately amount to Rs. 7,000.

Of the total quantity distributed, 111,600 lbs. were distributed outside the authorised area under sheer necessity, though indents for very large quantities of seed from Broach district beyond the Nerbudda river and for 600,000 lbs. from Nandod State had to be refused on account of want of seed. Similarly large indents of seed from Kanam (Miyagam-Dabhoi) side of the Baroda State had to be refused also. Most of these people were so keen to secure our improved seed that when they failed to secure it from the department, they purchased it from those gin-owners and merchants who had purchased our improved Kapas (seed cotton) from the cultivators who had grown it last year and ginning it separately had kept the seed separate for distribution in their own clientale as they found that the produce was better in ginning and quality.

This seed was distributed by them for sowing purposes. It is very difficult to get full information in this respect, but as far as my information goes, the following merchants and gin-owners have distributed the quantities shown against their names:—

No.	Name.	Quantity of cotton seed distributed in lbs.
1.	Ishwarlal Motiram Raghavji	... 120,000
2.	Mr. Bamanshah Jamasji, Surat	... 120,000
3.	Sardar Ishwarlal Store	... 240,000
4.	Messrs. Tata & Sons (Kim)	... 180,000
5.	The Sonsak Co-operative Society	... 240,000

6.	Ishwarlal Motiram Raghavji, Madhi ...	120,000
7.	Sisodra Gin—purchased by Mr. Bamanshah Jamasji ...	240,000
8.	Navsari-Billimora—seed—purchased by Mr. Bamanshah Jamasji.	228,000
9.	Vedchha Gin—seed—purchased by Mr. Bamanshah Jamasji.	132,000
10.	Ankleshwar Gin—seed—purchased by Mr. Bamanshah Jamasji.	240,000
11.	Sania Gin—seed—purchased by Kudsad people ...	180,000
	Total ...	2,040,000

18. Copies of the opinions of the persons who had purchased our cotton are attached herewith * to show how far they are liked by the traders.

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* Copy of letter, dated 18th June 1921, from Messrs. Narandas Rajaram & Co., Surat :—

"We are in receipt of your letter, dated 10th instant. In reply to it we have great pleasure in writing that cotton grown under the Supervision of the Government and generally termed as Government Farm cotton is good in feel and uniform in staple. It is also free from any mixture of low cotton, which is generally now-a-days done by some of the local merchants."

Copy of letter, dated 22nd June 1921, from Mr. Chhotubhai Bhaidas Marfatia, one of the most prominent Broker of Surat :—

"With reference to your letter, dated 10th instant, I have the pleasure to give my candid opinion on improved cotton as under:—

The cotton produced from the seed both Selection I-A and 1027 A. L. F. distributed by you in the Navsari, Surat and Bardoli districts, have been found superior to local cotton in staple, silkiness, strength and blow room less. The unit Selection of 1027 A. L. F. was really the best of all.

The cotton grown under your control can be spun into yarn 2 to 3 higher counts than the ordinary one. Its tension is also higher. The tension of the yarn 1027 A. L. F. is about 70 pounds, whereas of ordinary cotton is only 60 to 65 pounds.

From the above description I am led to believe that the unit Selection of 1027 A. L. F. if grown under favourable rains and other climatic conditions coupled with scientific method of cultivation, will give us a type of cotton capable of spinning 28-30 s. for warp. This had been usually obtained by the local Mills formerly from Navsari and Billimora cotton.

I further recommend that adulteration of Navsari cotton with the produce from Broach, Anklesar, Kosamba side should be stopped. If good seed is distributed in these parts, it will be some relief at present. If the cotton of the northern tract is improved, the high difference between the Navsari and Anklesar cottons which we find since last four years will fall down to its natural standard, and then will remain no inducement for the carting of cotton to long distances for obtaining higher prices."

Copy of letter, dated 22nd June 1921, from Mr. Dahyabhai Sunderji Desai, another most prominent Broker of Surat :—

"I am in receipt of your letter, dated 10th instant. In reply to it I have great pleasure in writing that the seed distributed last year by the Cotton Superintendent on behalf of the Surat Cotton Committee, the 1027 A. L. F type was found very useful and prolific in yield. It is also proved very superior in staple. The purchasers had paid very handsome rates for this cotton and it was really beneficial to the growers, gin-owners and Mill-owners who consumed the stuff.

I recommend this seed should be distributed in the whole of the Surat district as far as possible.

I purchased 50 gallis of 1027 A. L. F. seed from the department and got it distributed to my clients and I hope to purchase the resulting produce and keep the seed in pure state as far as possible. The seed will be enough for about 30,000 acres for the season 1922-23.

During the season I obtained and sold 110 gallis of Selection I-A seed to Sheth Bamanshah Jamasji. This gentleman supplied this seed to the Nandod State for sowing purposes. I think this cotton is rather short in staple and it should be very useful for the northern tracts.

I also purchased in the auction sale about 135 Khandis lint of the Athwa group—Selection I-A for the Surat Hatim Mills. The Mill-owner has expressed his satisfaction as he found this cotton superior to local one in strength, staple and blow room less."

Copy of letter, dated 1st July 1921, from Shah Jamnadas Chunilal, Cotton Commission Agent, Surat :—

"We have purchased Farm cotton about 500 Khandis during the current season from Sisodra, Vesma, Maroli Bardoli and Valod Gins. This was purchased at a premium of Rs. 15 to Rs. 20 per Khandi. We are Commission Agents for some of the best Ahmedabad Mills. Our Mill-owners have expressed a great satisfaction after using the cotton. This Farm cotton has given them much superior work to ordinary Deshi one.

The first lot put out by the department was not very good but the last two lots were excellent and we were again satisfied to see that the Farm cotton was, indeed, worth its name.

We are of the opinion that the general line of cotton is much improved than last year. The Surat cotton will regain its former reputation and can maintain its foremost rank if the gin-owners and the farmers continue in this way to work, use only good farm seed for sowing, and do not adulterate outside district cotton. The Government may press the ryot and if necessary enact laws to prevent them from sowing any other but the Farm seed and mixing low staple cotton with the indigenous."

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19. *Goghari Cotton Mixture.*—The survey of cotton fields was commenced from the middle of January by Mr. K. D. Naik, Cotton Superintendent and his Assistants Messrs. J. G. Jani and J. N. Patel, till the end of February. They visited as many fields as possible, maintaining other routine work relating to the established groups. Mr. V. G. Patel joined later on, but he could not do any survey work in the Ankleshwar taluka which was set apart for him. Like last year it was again felt that the work of Goghari survey could not be completed in the whole region by two men in a limited period of one month.

Goghari fields were traced only at—

Taluka.	Village.	Acres.	Percentage of Goghari.
Chorashi ...	Utran and Amroli	30	80
Bardoli ...	Mota	125	50

It seems people have now understood the defects of Goghari cotton and practically no efforts are now made to secure pure Goghari seed. Last year an area of 906 acres was traced under Goghari cotton.

The survey made by Mr. J. N. Patel shows rather heavy mixture of Goghari in Bardoli taluka. But this is due to the inclusion of short stapled plants counted as Goghari. For instance, Mr. Patel marked out 15 per cent. Goghari and 15 per cent. other short stapled plants in the fields of Bajipura. On the whole it seems the average for the Bardoli taluka comes to 15 per cent. of Goghari.

The local cotton of the Chorashi, Olpad and Jalalpur talukas show heavy mixture of Goghari 7 to 20 per cent., as the seed obtained from the gins has already been adulterated knowingly or unknowingly.

Fields sown with Farm seed by the cultivators in general show a very slight mixture of Goghari. This is due mainly to the standing ratoon in the fields and old seeds discriminated by rats, &c. A separate report in this connection was submitted to the Director of Agriculture, B. P., Poona, with this office No. C/165, dated 18th June 1921, from which it will be seen that the tendency to grow Goghari is getting less, but the mixture does exist there, as cotton (Kapas) is brought by carts from long distances on account of very big differences of prices between Surat-Navsari and Ankleshwar-Broach cottons. This will only be stopped slowly as the difference decreases due to the spread of our seed on a very large scale as is expected from this year's experience or when effective legislation is brought into force.

20. *Educative Effect of propagandistic Work taken up by the Department for the last two Seasons:*—

(1) From this year's indents for seed it is evident that people have now really begun to realize the importance of growing pure long-stapled cotton. The department kept the price of the seed higher than the local rate not with a view to make a profit, but in order to safeguard against ignorant cultivators taking the seed and using it for feeding the cattle. This purpose has been served from the fact that not only all the seed with the department has been sold off at such high prices, but that when the departmental stock was exhausted, the cultivators purchased seed even paying 25 per cent. higher price from merchants like Messrs. Tata & Sons and others who had got the pure seed from their clients growing this seed.

(2) From the past two seasons' experience the other cultivators who are growing our seed but who are not under the department's control have realized that they do not get the full price for their Kapas (seed cotton) as the cultivators of the controlled area do by our system of auction sales. Some of these cultivators are trying to follow our example of selling lint instead of selling Kapas, by getting it ginned separtely on their own account. The following group of persons had so ginned their Kapas and sold the lint either in the open market or with the department's help which was readily given :—

1 Sonsak and other adjoining villages, 2 Kudsad, 3 Antroli-Niol, 4 Baghumra, 5 Abrama, 6 Kharsad, 7 Affva, 8 Vankaner, 9 Satem, 10 Varad, 11 Jothan, 12 Astagam, 13 Bajipura, 14 Kani, 15 Eru, 16 A group of 18 Baroda State villages round about Sayan, 17 Kikabhai Paragji, Kim-Kachhap, 18 Raghnathji Nagarji, Olpad, 19 Natha Bhaga of Mulad Surat, 20 Khusal Morar Nansad (Bardoli), 21 Kushal Ratnaji of Vadoli.

Even then on account of the small lots put in for sale and the cultivators being ignorant of the tactics of the merchants as far as is ascertained they have not been able to realize the full market value of their produce. If this is not remedied and if cultivators growing our seed do not get good premium from the trade for their produce, it is feared that they will be dejected and the department will find it difficult to distribute large quantities of seed year after year. To remedy this evil, therefore

it would be desirable to have co-operative seed unions and sale societies, which might be in direct touch with the consumers and mill-owners for securing better prices to their constituent cultivators.

(3) The trade might be approached to send out their agents to make direct purchases from the cultivators or groups of cultivators who might try to gin their produce separately. If the trade tries to meet this demand, the department will try to help them by giving them the list of such cultivators who have grown our seed.

21. I take the opportunity of mentioning here the name of Mr. Keshavlal, the Mamlatdar of Ankleshwar, who opened a depot at Ankleshwar at his own initiative, and after getting registers prepared for the indents for our improved cotton seed from a group of about 25 to 30 villages of his taluka, distributed 142,350 lbs. of this seed at cost price to the cultivators without any difficulty. If all the Mamlatdars of the cotton growing tract were to take interest in this matter as Mr. Keshavlal, the work of the department will be very much simplified, and the distribution of seed and checking of the Goghari mixture will be carried out at a very little cost to Government. This does not involve any extra expenditure to the Revenue Department nor any great amount of work.

Mr. K. D. Naik, Cotton Superintendent, did very commendable work in cotton for the last two years, and it is a pity he has to revert for the convenience of the department.

Work done on Agricutulral Stations.

(1) *Surat Agricultiral Station.*

22. The season on the whole was a dry one, wanting in August-September rains. However, it proved good for cotton and fair for Jowar. The total rainfall was 25·02 inches in 54 days, as compared with 38·75 inches average and 41·97 inches in 48 rainy days in last year. The distribution was even except one heavy rain in June and long breaks in August and September.

23. *Seed-selection and Plant-breeding—*

(1) *Cotton.*—Cotton seed enough to sow the Farm area with selected strain of Selection I-A, Long Boll Type, was supplied by the Breeding Branch. This type is preferred to others, as the characters of bolls are vivid and distinct from those of others. Hence it will be possibe to detect any mixture or rogues in it in the boll stage and to keep the type pure. Further when it is distributed on a large scale to cultivators we can easily certify this type while examining the fields in boll stage and weed out the rogues.

The total area under cotton was 63 acres and 6 gunthas, sown largely with this variety which yielded on an average 631 lbs. per acre even in this dry year which is much higher than the average yield of the last year. The Farm crop was better than those of the cultivators yielding less than 400 lbs. per acre which shows an increase of nearly 57 per cent. Besides it gave better ginning and staple.

All the seed secured from this area was separately ginned and distributed amongst the cultivators of Athwa group of six villages. The total amount of seed of this type was 18,000 lbs. sufficient for 2,100 acres. The cultivators have been advised to dibble it in squares of 3 feet at the rate of 6 lbs. per acre and to use the remaining for redibbling if necessary, thus giving full chance of thorough cultivation to obtain higher yields.

(2) *Jowar.*—The selection work of three important varieties, *viz.*, Perio, Chapti and Sholapuri of this tract, is showing good results. The Farm selected seed showed its superiority over bazar seed in case of Perio by 18·2 per cent. or 124 lbs. more in grain and by 35 per cent. or Rs. 11-8-0 more in net profit per acre. While in case of Sholapuri the increase was 126 lbs. or 18 per cent., and the net profit was Rs. 11-8-0 or 52 per cent. per acre more than the bazar one. Chapti, too, gave 28 lbs. or 3·3 per cent. more yield and Rs. 5 or 14 per cent. more net profit, per acre.

Again, Budh Perio has given 210 lbs. or 53·8 per cent. more per acre in trials of large *versus* small grains; and 75 lbs. or 17·6 per cent. more per acre in trials of heavy seed *versus* light seed. Further it has given 55 lbs. or 16 per cent. more as compared with Chapti. This variety is popular with the cultivators and the demand for its seed is increasing and a large quantity is distributed as seed amongst the cultivators.

24. *Manurial Experiments.*—The manurial experiments of the last year were continued. They confirmed the results obtained in past years. The periodical application of night soil and poudrette enhanced the yield of cotton and Jowar to a great degree (*vide* page 32 of last year's report). It may be noted here that Jowar suffers more than cotton in dry years in poudrette plots.

In case of Jowar the commercial artificials gave a good start and better yield by 6 to 8 per cent. even in this dry season. But as the prices of these manures are high, the cost becomes prohibitive.

The two years' cotton rotation of San and fallow-in-strips has shown its superiority over the local rotation, namely, cotton and Jowar (*vide* Statement I below) :—

STATEMENT No. I.

Plot No.	1917-18.					1918-19.				
	Crop.	P. P.	B. P.	Value.	Cost.	Crop.	P. P.	B. P.	Value.	Cost.
		lbs. oz.	lbs. oz.	Rs. a. p.	Rs. a. p.		lbs. oz.	lbs.	Rs. a. p.	Rs. a. p.
I	Cotton and san in strips.	277 12	725 0	112 10 2½	60 1 7	San and cotton in strips.	269 8	494	73 6 11	38 3 4
II	Perio Jawar and pulses.	J 588 8 T 95 8	J 1,268 8 T 778 8	77 6 3	53 2 1	Cotton ...	428 8	986	117 8 3	61 15 1½
III	Cotton and fallow-in-strips.	348 12	695 0	106 5 10½	41 1 4	Fallow and cotton-in-strips.	335 8	578	91 4 6½	40 10 5
IV	Fallow ...				38 11 3	Cotton ...	429 0	1,222	116 15 ½	42 0 11

	1919-20.				1920-21.				Average.			Remarks.
Crop.	P. P.	B. P.	Value.	Cost.	Crop.	P. P.	B. P.	Value.	Cost.	Value.	Cost.	Net profit.	
	lbs. oz.	lbs. oz.	Rs. a. p.	Rs. a. p.		lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Cotton and san in strips.	464 8	1,393 8	199 9 9	49 12 8½	San and cotton-in-strips.	411	623	73 14 9	62 0 9	94 14 5	52 8 7	42 0 10	
Jowar ...	887 0	1,865 0	80 1 3	56 7 10	Cotton ...	575	803	103 1 6	79 7 9	94 8 4	62 12 3	31 12 1	
Cotton and fallow-in-strips.	529 8	1,588 8	136 5 6	47 14 7½	Fallow and cotton-in-strips.	385	578	69 6 0	45 6 6	100 13 6	43 12 2½	57 1 3½	
Fallow ...				38 12 11	Cotton ...	538	773	94 10 5	50 6 9	52 14 4½	41 3 11½	11 10 5	

NOTE.—The results of San and fallow-in-strips are better than those of local rotation of cotton and Jowar; the experiment is continued for further observation.

25. *Cultural Experiments.*—Dibbling *versus* drilling gave appreciable results in favour of the former, and besides maintaining an ideal tilth and cleanliness made the operations easy and convenient at any time. The results were decidedly in favour of dibbling in case of cotton by 15·1 per cent., while the following Jowar crop yielded 14·1 per cent. more. The crop of this year yielded the highest, *viz.*, 524 lbs. per acre, in comparison with the average of past four years, *viz.*, 480 lbs. per acre.

Regarding the economy of running the commercial block, it is interesting to note this year that the net profit in case of cotton is 145·8 per cent. as compared with 88·8 per cent. of last year over the investment, even though the rate of cotton this year was much lower (nearly half) than that of last year. The average yield of cotton per acre of this block was 672 lbs., and that of Jowar 777 lbs. In case of Jowar, too, the net profit was 111·9 per cent. as compared with 50·4 per cent. of the last year over the investment, which shows that this block had been run on a far rigid economic basis.

26. *New Experiments.*—As mentioned in the last year's report the special experiments of ridge and furrow cultivation combined with good manuring were commenced from this year to obtain the highest yields of cotton and Jowar as suggested by Dr. Mann, the Director of Agriculture. The ridges and furrows are so made as to achieve the following objects as far as possible:—

(1) To store up all the rain water in the soil as far as practicable for the best use of the crop.

(2) To cultivate the soil in such a way as to give better chances to all the natural agencies to play their full part and to give the greatest range of root-growth to the plant.

(3) To improve the physical texture and fertility of black cotton soil by bulky and artificial manures.

(4) To avoid the evil effects of heavy and continuous rains of July-August and to drain the soil to the greatest advantage for the successful growing of the crop by maintaining the optimum condition of black soil throughout the monsoon.

As the season turned out to be a dry one, after waiting long for rain till October, it was decided to irrigate a part of each of the plots to see if under normal rain conditions the yields of these plots would have been more. By the time the irrigation was resorted to, the crop had advanced too far to be materially benefited, though there is some gain as will be seen from Statements Nos. II and III below. In the case of Jowar Statement No. II there is an increase of 755 lbs. of grain per acre over the control plot yielding 845 lbs., *i.e.*, nearly 90 per cent. in irrigated portion; while in the case of dry crop the increase is 312 lbs. or 37 per cent. over the standard plot. The charges of cultivation in the

ridge system are less by Rs. 2 per acre than the ordinary system, even though the preparatory tillage was higher in the former, thus showing considerable saving in weeding and interculture. The ridged plots have paid up Rs. 23 to 40 to the item of manuring this year after deducting the net profit of the check plots, and it is hoped that better returns will be obtained in future:—

STATEMENT No. II.

Statement showing the Results of Jowar (Perio) of the high yield Experiment on the Surat Farm during the year 1920-21.

Plot No.	Area.	Treatment.	Outturn per plot.			Outturn per acre.			Per cent. increase in gain.	Value of produce per acre.	Cost of cultivation per acre.	Net profit per acre.	Remarks; gain over standard.
			Grain.	Chaff.	Kadbi.	Grain.	Chaff.	Kadbi.					
	A. g.		lbs.	lbs.	lbs.	lbs. oz.	lbs.	lbs.		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
1A2	0 4	Drilled 2′×2′	82	16	297	845 0	170	2,820		136 11 3	63 11 0	73 0 3	
1B2	0 4	Do.	87	18½	265								
2A	0 8	Dibbled 3′×3′ 5 plants in a dibble	229	75½	686	1,167 5	270	3,970	37·8	191 5 0	63 2 7	128 3 5	55 3
2B	0 8	Do.	238	82½	903								
3A1	0 4	Dibbled on ridges 4′×1′ single plant.	163	20.	329	1,600 0	195	4,000	89	223 4 0	99 15 4½	113 4 9½	40 4 6
3B1	0 4	Do.	157	19	471								
3A2	0 4	Do.	115	20	290	1,157 5	175	2,950	37	163 6 2	59 15 4½	103 6 11½	30 6 8½
3B2	0 4	Do.	116½	15	300								
4A1	0 4	Dibbled on ridges 4′×1′ 5 plants in a dibble.	113	19	252	1,220 0	360	2,835	44·3	168 5 10	100 15 5¾	67 4 4	−5 11 9
4B1	0 4	Do.	131	53½	315								
4A2	0 4	Do.	113	26	306	1,090 0	215	3,035	29	161 1 10	64 15 3¾	96 2 6¼	23 2 3¼
4B2	0 4	Do.	105	17½	301								

NOTE.—Plots 3A1, B1, A2, B2, and 4A1, B1, A2, B2, were manured with 50 C. L. of F. Y. M. 2,000 lbs. of cotton seed hulls, 300 lbs. hydrated lime, 200 lbs. of fine dry sand, 300 lbs. of wood ashes, applied just before rains in furrows and 400 lbs. of cotton seed meal, 1,000 lbs. of Rockphosphate and 400 lbs. of dry sand (fine) per acre in September costing Rs. 174-4-6 to last for 4 years. Plots Nos. 3A1, B1, 4A1, B1, were watered twice in October and November with 6 inch watering altogether, others were dry.

STATEMENT No. III.

Statement showing the Results of High Yield Experiments on Cotton (Selection-I. A. L. B.) on Surat Farm 1920-21.

Plot No.	Area.	Treatment.	Manure.	Outturn per plot in cotton.	Average.	Outturn per acre.	Gain.	Gain per cent.	G. P.	Lint.	Increase.	Increase per cent.	Value of produce.	Cost of cultivation.	Net profit.	Remarks gain over standard.
	G.			lbs. oz.	lbs. oz.	lbs. oz.	lbs.			lbs. oz.	lbs. oz.		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
5A	8	Dibbled ordinary 2′×2′.	Nil.	96 12	96 4	481 4			39·7	191 1			100 7 3	54 7 8	45 15 7	
5B	8	Do.	Nil.	95 12												
6A	8	Dibbled 3′×3′.	Nil.	129 0	127 4	636 4	155	32·2	41·4	263 4	72 3	39·9	136 14 7	51 3 0	85 11 7	39 12 0
6B	8	Do.	Nil.	125 8												
7A1	4	Ridged 6′×1½′ irrigated 6″ twice.	50 C. L., F. Y. M., &c.	80 8	89 6	893 12	412½	85·7	39·6	353 9	168 8	88·3	185 13 7	102 1 7½	83 12 0	37 12
7B1	4	Do.		98 4												
7A2	4	Ridged 6′×1½′ dry.		79 8	81 6	813 12	332½	69·1	40·3	327 9	136 8	71·5	159 6 5	62 1 7½	97 4 10	51 5
7B2	4	Do.		83 4												
8A1	4	Ridged 6′×3′ irrigated 6′ twice.		103 0	103 8	1,035 0	554½	115·3	39·6	409 8	218 7	113·9	215 5 10	103 1 7	112 4 3	68 4 8
8B1	4	Do.		104 0												
8A2	4	Ridged 6′×3′ irrigated 6″ twice but dry.		85 12	87 4	872 8	391½	81·3	40·1	349·8	158 7	83·0	183 3 10	63 1 7	120 2 3	74 2 8
8B2	4	Do.		88 12												

Cotton stalks are being dug out the weights of which will be recorded in its proper place in future. Plots Nos. 7A1, B1, 7A2, B2, 8A1, B1, A2, B2, were manured with 50 C. L. of F. Y. M. 2,000 lbs. of cotton seed hulls, 300 lbs. hydrated lime, 200 lbs. of fine dry sand, 300 lbs. of wood ashes applied just before rains in furrows and 400 lbs. of cotton seed meal, 1,000 lbs. of rockphosphate, 400 lbs. of fine dry sand applied in September. (These manures were applied above rate per acre) Costing Rs. 174-1-6 in all. (4 years.)

The results of cotton (*vide* Statement No. III) show a more interesting feature as the crop is deep rooted. To see how far the yields are affected by 6" irrigation, halves of the plots 7 and 8 were watered, while the remaining portions were kept dry. The watering charges have not been proportionately repaid by the increased yield as stated above. Again it was expected in this dry season that the heavy doses of manure would dry up the crop, but the better yield in the dry plot over the standard plot proves that the manure was thoroughly incorporated in the soil and that there existed better conservation of requisite moisture. In the ridged plots the increase in yield ranges from 70 per cent. to 115 per cent. and have paid up Rs. 38 to 74 to the manuring item.. After deducting the extra picking charges of increased yields, the cost of cultivation of the ridged plots comes to Rs. 58 as compared with Rs. 54-8-0 of the check plots. The preparatory charges of ridging 14" deep were Rs. 8 more, while the resulting difference is Rs. 3-8-0 only, indicating a saving of Rs. 4-8-0 in weeding and interculturing.

In order to determine the minimum number of plants required per acre to give the highest yeield in this system, the following spacing experiments were tried with cotton dibbled on ridges :—

Space.	Irrigated.		Dry.		Remarks.
	Yield per acre in lbs.	Ginning percentage.	Yield per acre in lbs.	Ginning percentage.	
5′ by 2′ ...	830	40·2	720	41·0	
4′ by 2′ ...	772	40·3	755	41·0	
3½′ by 2′ ...	933	39·3	831	40·2	Little low lying.
5′ by 4′ ...	920	38·4	782	39·5	
4′ by 4′ ...	1,044	38·4	890	40·1	
3½′ by 4′ ...	982	38·5	909	39·2	

It will be seen from the results that 3½′ by 4′ and 4′ by 4′ have given the best results, while 5′ by 4′ have also given good results in both irrigated and dry portions. The ginning percentage is 1 per cent. higher in dry plots than that in the irrigated ones, and again it is 1 per cent. higher in thicker sowings, indicating inferior staple to that of irrigated and wider sowings.

The following few advantages in ridge and furrow system are observed :—

(1) It affords a perfectly drained bed for the seed to germinate.

(2) It stores water in the furrow which rises by capillarity to serve as subsoil irrigation when the rains hold off.

(3) The plant sent down deep tap-root faster than on the flat in rains.

(4) The furrow serves as feeding trough for the secondary roots to strike in and feed on the soil.

(5) In a dry year the crop can be saved by thorough establishment of deep root system and better conservation of moisture while the same on flat is likely to fail.

(6) In a wet year it preserves the crop from evil effects of washing and water logging.

(7) It provides sufficient aeration which increases nitrification in monsoon.

(8) The crop can be very easily established when the season is unfavourable for sowing with a drill.

(9) The operation of dibbling is far cheeper than sowing in case the germination is defective. In such cases this secures the best and even germination.

(10) The wider space between the two rows facilitates the necessary after-tillage. In a year of well distributed rain, the deep moist furrows require the least interculture.

(11) It is possible to take catch crops like rice, groundnut, &c., in the furrows to utilize the excess water in years of heavy rainfall.

(12) In this system the plants remain green for a longer period ensuring three regu ar pickings for full development and opening of the bolls.

(13) Cotton with a little longer staple could be grown on these ridges, as they conserve moisture for a longer period than would be the case on flats.

(14) The cracks in the soil in winter and summer are comparatively less than on the flat system.

(15) The crop (plants) on the ridge system is more uniform in height and bushy growth than that on the flat.

This system seems to promise well, and if the results in good average years turn out according to expectations, this system is expected to revolutionize the cultivation in the Presidency and specially so of black tracts. The trials are laid out on all the Farms in Gujarat for this season, and after a year or two, if successful, it will be demonstrated all the Presidency over.

27. *Experiment of sowing a low-lying poor area on high ridges.*—To demonstrate the advantages of dibbling cotton seed on ridges in water-logged areas of Olpad and Chorashi talukas and in low-lying black soils of Surat and Broach, a large plot of 10 acres and 27 gunthas in the Block C on the Farm was ridged and dibbled with cotton. This plot being low-lying required usually three resowings in the past seasons and is considered as the poorest area on the Farm. The first dibbling after ridging was thoroughly established and has yielded well (616 lbs. per acre) without any manure, *i.e.*, 70 per cent. more than the cotton yield of 1918-19 (356 lbs. per acre) of the same field. Again it has yielded 60 per cent. more than the average (378 lbs. per acre) of cotton grown in the same field from 1907-08 to 1916-17 with artificial manurial treatment. The cost of cultivation of this field according to this new method came to Rs. 53-10-0 per acre as compared with Rs. 51 of other commercial plots dibbled 3′ by 3′ on the flat. This has served a very useful demonstration to the people of Surat and Broach districts.

28. The *McCormic Daisy Reaper* was worked in harvesting all the commercial Jowar plots this year. It is found to be working satisfactorily, as it cuts 6 acres of Jowar per day of eight hours with one pair of bullocks and a man with two females, equal to the work of 36 females or the labour of Rs. 11-4-0. The cost with the machine was Rs. 2 for bullocks and labour and Rs. 1-8-0 for the hire of implements per day, thus costing nearly 31 per cent. of the labour required.

Besides, we introduced the use of a grass mower this year which facilitates our work. This is a good asset to the Farm where silage is to be fed and hay made and where labour is scarce.

29. *Fodder Experiments.*—In the Athwa area, only the promising varieties of Jowar *viz.*, Perio and Sundhia were tried in about 6 acres; out of which Perio gave 18,658 lbs. of green fodder per acre in a year of scarcity in one cutting only, while Sundhia ripened earlier at the cost of the second cutting giving only 10,050 lbs. per acre, as the late rains were wanting.

During the year under report, one more Katcha Silo was added from the funds of Sir David Sassoon to the already two existing silos, due to the existing want of green fodder.

Silo No. 1 was filled with green grass from the headlands and threshing yards, and No. 2 with green Sundhia and the grass from Police Lines. The former being very old and cracked does not promise to give a good percentage of useful silage as usual. It is still being fed to cattle. Silo No. 2 gave 75·88 per cent. against 67·8 per cent. of useful silage obtained last year, due to very careful packing by bullock weight.

Katcha Silo was specially prepared at the Rifle Range to improve the grass lands and to utilize the rank grass as silage, and to have a second cutting for hay, which stored 271,777 lbs., giving 57·25 per cent. useful silage, costing Rs. 16-6-7 per 1,000 lbs. of good silage. The former two objects were fulfilled, while the last one was only partially attained as the late rains were wanting. This kept the dairy cattle in excellent condition in winter and summer. Besides, this year the whole of the Perio fodder was saved and fed green to the dairy cattle for two months, *viz.*, November and December.

In order to demonstrate what could be done in a famine year, to obtain the highest yield of Perio fodder, a part of the land was heavily manured and irrigated twice giving 35,909 lbs. of green fodder per acre.

30. *Breeding Herd.*—A breeding herd of Kankrej animals has been maintained for milk and stud purposes. The strength of the herd on 1st April 1921 was 102 of all classes as against 87 of last year (*vide* Statement No. IV below). The total yield of milk obtained from 31 cows was 75,153 lbs., 12 ozs., as against 78,495 lbs., 12 ozs., from 35 cows in 1919-20. Out of 31 cows, 3 heifers calved towards the end of the year, 1 cow was old, 1 aborted and one died just after parturition. Practically, therefore, the yield was from 25 cows; and if we were to calculate the milk yield only from these 25 cows from their own yields, we would get an annual average per cow as 2,738 lbs. 9 ozs. as compared with 2,636 lbs. of last year from 29 cows. The old cow Parjani referred to in the last year's report to have given good results was not milked, because she had to suckle two calves—one her own and the other, an orphan of cow Parel.

STATEMENT No. IV.

Statement showing the Strength of the Herd on 31st March 1921, on the Surat Farm Dairy.

No.	Description.	Strength of the Herd on 31st March 1920.	Purchased during 1920-21.	Born in 1920-1921.	Transferred from Bull or She-calves.	Total of Cols. 4 to 6.	Total of Cols. 3 and 7.	Died in 1920-1921.	Sold in 1920-1921.	Transferred or otherwise disposed off.	Total of Cols. 9 to 11.	Balance on hand on 31st March 1921.
1	Bulls ...	3				4	3		1		1	2
2	Cows ...	27			6	6	33	3			3	30
3	Heifers ...	14			7	7	21			6	6	15
4	Bull-calves ...	18		11		11	29	4	5		9	20
5	She-calves ...	26		16		16	42			7	7	35
	Total ...	87		27	13	40	128	7	6	13	26	102

The Farm-bred cow Budhi shown in the last year's report has given an annual average of 3,213 lbs. 8 ozs. in 8 years after first calving. This year two new breeding bulls named Kevdo and Dev have been selected from record cows Lehra and Pitambari having their own respective annual average of 8 years as 3,543 and 3,025 lbs.

During the year under report, there were 27 births as against 31, and 7 deaths as against 9 of the last year. This year only 6 bulls were sold—3 to the Chharodi Cattle Farm and 3 to local cultivators, fetching a price of Rs. 1,175.

During this year, Rinderpest and Foot-and-mouth diseases prevailed amongst the cattle, but our herd was saved by timely inoculation and careful hygienic treatment, with one casualty only in Rinderpest.

(2) *Amalsad Sugarcane Farm.*

31. The same experiments to check *red rot* in sugarcane were continued. Only the following seven varieties instead of ten were tried, the three unpromising ones being rejected :—

(1) Malbari, (2) Striped Mauritius, (3) Red Mauritius, (4) Manjav, (5) Pundya, (6) Khajuria and (7) J. 247.

Out of these seven varieties tried on the Farm, Striped Mauritius, J. 247 and Manjav have given very promising results, giving 116,224 lbs., 114,240 lbs., 82,260 lbs. of canes and 11,390 lbs., 9,120 lbs. and 7,232 lbs. of Gul respectively per acre, though the year was a year of scanty rainfall—registering only 36·45 inches of rainfall as against the average of 49·98 inches.

32. There was a very great demand for seed from the cultivators for three or four promising varieties. As it was not possible to meet the full demand of the cultivators, it was decided to reserve canes of half of the plots of each promising variety for crushing and sell those of the other halves as sets to cultivators at 10 per cent. premium price over the prevailing rates of Malbari canes which are considered to be the highest as compared with those of other local varieties of canes in the tract. During the year under report there was no red rot at all either on the Farm or in the surrounding tract.

33. In this tract (Southern Surat district) there is a very long standing practice of sowing whole canes with a Nagar (a heavy plough) instead of set planting. After the existence of the Amalsad Plot for nearly 7 or 8 years, some of the surrounding cultivators seem now to be convinced that by set-planting better and even germination is secured than that obtained by sowing. They have begun to adopt this new Manjri method of set-planting wide apart and they are given all facilities for so doing, by lending them free of charge the iron ploughs and the ridging plough whenever asked for.

34. The Agricultural Chemist and the Assistant Professor of Mycology who were pleased to co-operate in the investigation of red rot, started their investigations first to ascertain and see if there be any injurious salts in the soils or well-waters used for irrigation developing at any particular season and encouraging the appearance of red rot.

Soil samples from the plots growing canes and water samples from all the Farm wells were taken every five weeks and analysed, but no injurious salts were found in either case. Further experiments by these two officers are in progress during the current season.

(3) *Broach Farm.*

35. This Farm was started solely with the idea of finding out the most suitable type of cotton for the Broach tract. The work at present consists mainly on varietal, cultural and breeding experiments in cottons. In the absence of a Government Farm in Dholera (North Gujarat) tract, the work in *Lalio* and *Wagad* cottons also was carried, on this Farm for the last 3 years. As a plot of about 12 acres has been opened recently at Sanand during the current season, the work in Lalio and Wagad cottons will be transferred there.

The work in Goghari is also limited to a very small extent for preserving some few pure strains with very high ginning percentage for crossing purposes with superior stapled varieties with low ginning.

36. The whole Farm area was sown this year with Selection I-A cylindrical boll type—the variety intended to be distributed in the district, as this variety has got a better ginning percentage with a fairly good staple. The resulting seed 1,600 lbs. was all secured by the department, by getting the produce separately ginned. This total quantity of seed nearly enough for 200 acres has been given to 5 or 6 good cultivators of Samni on condition of keeping the produce pure and separate and of selling the resulting seed back to the department at market price. If the variety is liked by the trade and cultivators, then a modest beginning will be made of distributing the resulting seed which will be enough for about 2,000 acres next year.

(4) *Dohad Farm.*

37. *Seed Selection.*—Seed selection in wheat and maize was continued. On account of the sad death of Mr. Chibber, the Plant Breeding Expert, this work which was to be handed over to him had to be continued.

The Wajia-Popatia cross has further verified its promising features as (1) a high yielder as compared with others on a field scale, and (2) mostly rust-resistant.

Seven promising strains of Wajia wheat—the local variety of the tract were separated and were sown separately for multiplying the seed. This seed will be sown on a field scale this year to be compared with the ordinary local seed.

Similarly, the breeding of pedigree seed in maize was also continued during the year. 29 Heads selected last year were separately sown from which 10 promising cobs were selected for further propagation.

38. *Wheat.*—Several varieties of wheat are being tried since long on this Farm. The following statement shows the yields of the different varieties:—

Name of the Variety.	Yield in lbs. per acre.		Value of produce.	Cost of production.	Profit or loss.	Valuations per 40 lbs.
	Grain.	Chaff.				
Wheat.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Baxi ...	1,470	1,470	149 15 0	54 4 0	+95 11 0	4 0 0
W. × P. ...	1,455	2,482	114 1 5	54 4 0	+59 13 5	3 0 0
Bansi ...	1,305	1,425	133 5 7	54 4 0	+79 1 7	
Pissi ...	1,200	1,950	101 6 4	54 4 0	+47 2 4	3 4 0
Dhola Katha ...	1,147	2,317	119 6 3	54 4 0	+62 2 3	4 0 0
Wajia ...	1 032	855	79 1 8	54 4 0	+24 13 8	3 0 0
Pusa 4 ...	840	1,155	75 13 0	54 4 0	+21 9 0	3 8 0
Pusa 12 ...	772	1,800	66 5 0	54 4 0	+12 1 2	3 4 0
Australian 56 ...	757	2,025	65 8 0	54 4 0	+11 4 0	3 4 0

From the above it will be seen that the Wajia × Popatia cross has given very good results. The Pusa 4 and Pusa 12 and other ownless varieties were damaged by pigs; otherwise they too yield better on the Farm and also in the district. Seeds of these promising varieties have been introduced where soil conditions are suitable for them.

39. *Maize.*—In the case of this crop as reported last year on page 36, drilling *vs.* sowing maize after a plough has resulted in further confirming the fact that drilling

maize is better than sowing it after a plough, as will be seen from the following table:—

Plot No	Treatment.	Yield per acre.		Value.	Cost of production.
		Grain.	Chaff.		
		lbs.	lbs.	Rs. a. p.	Rs. a. p.
6	Sown behind a plough, 18″ apart ...	1,683	1,863	86 0 3	60 12 9
7	Sown by a drill 18″ apart ...	1,904	2,194	97 6 2	61 7 9

Another interesting experiment is being conducted to see if the sowing of maize could profitably be postponed with a view to escape the ravages of Hairy Caterpillars (Katra) which appear in large numbers with the first fall of rain and damage the maize crop sown early with the first fall. In order to ascertain the best time of sowing maize it was decided to sow maize every week commencing with the general sowing of the Farm for a month. This will also prove whether early or late sowing is profitable. The results are given in the following statement:—

Plot No.	Time of sowing.	Yield per acre in lbs.		Value of produce.	Cost of production.	Profit or loss.
		Grain.	Fodder.			
		lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
42-44 A ...	1st week ...	1,836	1,296	93 1 1	34 9 6	+58 7 7
42-44 B ...	2nd „ ...	1,488	2,256	76 10 5	28 6 0	+48 4 5
42-44 C ...	3rd „ ...	1,648	2,064	84 8 2	32 2 0	+52 6 2
42-44 D ...	4th „ ...	1,636	1,920	83 12 4	29 12 0	+54 0 4

From the statement it will appear that the first sown plot yields better, though the difference is not so great this year, as it is in a wet year.

40. Similar experiments, as those tried at Surat of *ridge and furrow* cultivation, were tried here on maize to see to what extent the yield of maize could be raised by heavy manuring and special cultural treatments. The following statement gives the results:—

[For statement *see* page 57.

Plot No.	Name of crop.	Manurial Treatment per acre.	Cultural Treatment per acre.	Yield per acre. Grain.	Yield per acre. Chaff or fodder.	Increase or decrease of produce over the standard. Grain.	Increase or decrease of produce over the standard. Chaff or Fodder.	Per cent. increase in grain over standard	Value of produce per acre.	Cost of production per acre.	Net profit or loss.	Total profit or loss.	Gain or loss over standard.	Amount paid up to the manurial and cultural item.	Remarks.
				lbs.	lbs.	lbs.	lbs.		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
2627 A.	K. Maize. R. Wheat.	50 C. L. of F. Y. M. 2,000 lbs. of cotton seed hulls. 300 „ „ Hy. lime. 200 „ „ fine dry-sand. 300 „ „ wood ashes. 400 „ „ C. S. meal. 1,000 „ „ R. PO 4. 400 „ „ E. dry sand.	4′ × 2′ on ridge 14″ high, dibbled.	2,835	902 (F)	+ 179	— (173)	6·74	142 10 6	390 9 10	—247 15 4	—133 13 3	—201 3 5	97 10 11	
			Local (Rabi) ...	1,850	4,600 (C)	+ 883	+ 1,989	86·8	179 6 7	65 4 6	+114 2 1				
2627 B.	K. Maize. R. Wheat.	Do.	4′ × 1′ dibbled on ridge.	3,353	1,075 (F)	+ 697	Nil.	26·2	168 11 5	395 0 0	—226 4 7	—103 2 1	—170 8 3	133 12 3	
			Local (Rabi) ...	1,945	4,319 (C)	+ 928	+ 1,708	91·2	189 7 0	65 4 6	+123 2 6				
2627 C.	K. Maize. R. Wheat.	15 C. L. of F. Y. M.	4′ × 1′ on flat and drilled thinned and earthed up by T. M. Plough.	3,040	883 (F)	+ 384	— 192	14·4	152 13 0	96 13 0	+ 56 0 0	+113 1 1	+ 45 10 11	50 12 5	
			Local (Rabi) ...	1,267	3,167 (C)	+ 250	+ 556	24·5	122 5 7	65 4 6	+ 57 1 1				
2627 D.	K. Maize. R. Wheat.	15 C. L. of F. Y. M.	Sowan with a Plow (Local Method).	2,656	1,075 (F)	Standard.	Standard.		133 13 9	91 11 6	+ 42 2 3	+ 67 6 2	Standard.		
			Local (Rabi)...	1,017	2,611 (C)	Standard.	Standard.		90 8 5	65 4 6	+ 25 3 11				

N. B. I.—In plots A, B, and C., Maize cobs and grains were well developed, while in case of wheat, both straw and grain were remarkably better in these plots than in the standard. The experiment is to be continued for 4 seasons and it is hoped that plots A and B will give better economic results in future.

N. B. II.—Plots A and B have paid up rupees 98 to 134 to manurial and cultural items, while C has paid up Rs. 51 to the cultural item only.

(5) *Nadiad Farm.*

41. This Farm is solely meant for fodder growing, but owing to insufficiency of water in the existing well, that object is not carried out to the full extent.

Trials on different *fodders* were continued, but as the rainfall was very deficient and there was not enough water in the well, the comparative yield of different fodders was in most cases below the average.

42. Some of the area was utilized for trial of new crops such as *chicory* and *beet roots*, which appear to be profitable crops and can be taken up willingly by the cultivators if there be demand for their produce in the market.

For *chicory* there is only one customer, *viz.*, Messrs. Polsons, Ltd., of Bombay. This firm purchases the fresh roots of chicory grown on the Farm as well as by cultivators at Rs. 2 per 40 lbs. delivered on the Farm. This pays better to the cultivators than any other crop of the district.

The average outturn of fresh roots of chicory per acre on cultivators' fields came to nearly 6,000 lbs., while that on the Farm came to 7,421 lbs. The cost of cultivation per acre came to Rs. 326-2-3, while the value of the produce realized* was Rs. 371-1-6, thus leaving a net profit of Rs. 44-15-3 per acre. The bye-product of chicory leaves got by regular cuttings at an interval of a month or so was also utilized by cultivators for feeding the cattle. These leaves are relished by cattle in the absence of any good fodder. This new crop can only be extended on a large scale if there is a regular market for it.

43. *Beet Roots.*—The trial of beet-root is not a new one on this Farm. This crop was tried here successfully in past years. But the difficulty for manufacturing refined sugar from these roots consists in building a large factory, as no small machinery can be had for this purpose. The cultivation of this crop has been again taken up with the object of bringing to the notice of the trade the results of the trial of this crop in order that they may consider the desirability of manufacture of refined sugar from beet-roots on a large scale.

Four different varieties of sugar beets were tried during the year under report. The seeds were obtained from Paris, America and Calcutta. The cultivation does not require very great skill on the part of cultivators. Seedlings are raised and after they are six weeks old, they are transplanted in furrows under irrigation by the middle of November. The plants establish well in winter and roots began to develop when they were earthed up and ridges were formed. The crop was ready for harvest within 4½ months from the date of transplanting. If it is allowed to overripen, the roots would begin to crack and split. The maximum weight of a root was 5½ lbs. and the minimum ½ lb. The following table shows the results :—

Name of Variety.	Yield of green roots.	Cost of cultivation.	Value of produce.	Net + profit or —loss.	*Percentage of non-reducing sugar from sample sent on 7-3-21,	28-3-21.
	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
French Vilmorine "A" ...	10,371	357 4 0	324 1 6	— 33 2 6	17·59	19·08
Do. do. "B" ...	18,876	357 4 0	589 14 0	+ 232 10 0	19·31	16·47
American ...	23,672	357 4 0	738 8 0	+ 381 4 0	19·53	15·88
Refined Sutton ...	20,570	357 4 0	642 13 0	+ 285 9 0	19·05	16·15

* These figures have been kindly supplied by the Agricultural Chemist, Poona, to whom the samples of roots were sent for finding out sugar percentage.

The trial was on a very small area and it is expected that the yield can still be increased and the cost decreased to a great extent.

The by-product of leaves and tops can also be utilized by feeding to cattle which relish them. From Bulletion No. 40 of the department of Agriculture, Victoria, Australia, it appears that the beet crowns and tops can also be siloed or fed dry, and these are considered as *ideal* for fattening stock. In this bulletin it is stated that good average beets should test 15½ per cent. of sugar at a purity of 85 per cent. Looking to this, the sugar percentage in beets given in the above table seems really encouraging. The crop will again be tried on a large scale to see whether the yield can be increased and the cost of cultivation can be decreased. The results obtained do not seem to be discouraging and the beet sugar industry in North Gujarat can be profitably developed on a very large scale if capitalists come forward and build a large factory, the cost of which, of course, seems exhorbitant, as it is seen from the bulletin above referred to that the cost of the Plant and buildings had cost the Company there approximately £ 75,000 in 1898-99. The department, however, will try this crop for one year more to arrive at definite results of yield and cost of cultivation. It will then be for the trade to decide whether to take up this beet sugar industry side by side with the cane sugar industry.

Agricultural Education.

(1) *Vernacular Agricultural School, Godhra.*

44. The School situates about three miles to the west of the Godhra Railway Station in the limits of Ambali village. The site with the adjoining Farm area of 30 acres was given to Government free of cost by Mr. Rustomji R. Dalal, a Parsi gentleman of Godhra. Government sanctioned the school in the year 1914; but on account of a sudden outbreak of the World-War, the construction of the buildings and the starting of the school were postponed till the close of the War. The school buildings were ready by the beginning of April 1920 and the school commenced working from 1st June 1920 with 20 boys. As this was a new institution of its kind in Gujarat, it was rather found difficult to secure the true type of boys for the school. However, the Head Master and myself tried our utmost to secure the desired type of boys and succeeded in getting them. Out of the 20 boys, two had to leave the course on account of unavoidable family circumstances. Of the remainder, 15 are from the Panch Mahals and 3 from the Kaira district. When arranged according to caste, they stand as follows:—

Brahmins	....	Nil.
Dharalas	...	7
Patidars	...	6
Rajputs	...	5
Total	...	18

All of them being from regular cultivating classes.

45. *Health.*—The general health of the whole institution remained quite satisfactory during the whole year, there being no illness of any kind worth mentioning. This may be mainly due to the best sanitary situation of the school buildings.

46. *Staff.*—Mr. J. G. Naik, B.Ag., worked as Head Master of the school for the whole year. He is assisted by two assistants—one, a non-graduate fieldman and the other, a trained teacher from the Educational Department.

47. *Curriculum.*—This is based on similar lines both as regards theoretical and practical work as those of the Loni School, with such local changes as are required for Gujarat conditions. This school is purely meant for real agriculturists' sons who cannot afford to take advantage of higher education and hence the boarding, lodging and teaching are given free of cost in this school.

48. *Farm.*—The area of the Farm was mostly under grass and had to be reclaimed and levelled. By the setting of the rains, nearly half the area was reclaimed and sown with different Kharif crops to serve as demonstration to the students, and the work of reclaiming the rest is in progress. The Farm well newly built by the Public Works Department does not contain enough water for irrigation, and hence the growing of irrigated crops will have to be postponed till the water supply is improved by boring.

49. *Examination.*—The annual examination was held in April 1921 by Mr. K. B. Naik, Superintendent, Surat Farm, alone, as the Inspector of Agricultural Schools could not come up for the purpose. Out of 17 students that appeared, 11 passed fully, 3 passed with grace (one in Nature study and 2 in Geography).

The examiner has remarked as follows:—

"* * * Majority of the students have secured over 40 per cent. in total and curiously enough all of them have got through the practical. One Dharala boy named Shabhai Daji secures over 60 per cent. and stands first in the list while all the Patidar boys have passed with good ranks. On the whole the boys did well in practical and principal subjects of Agriculture, Nature study, Language and Sanitation.

"It appeared to me that if the boys are trained in the mode of answering papers, they would be able to express themselves in a better way, and for this I suggest that monthly or at least quarterly examinations may be held by the school staff in future.

"I am glad to report that the boys have stood a fairly good test this year and a good number of students had shown good progress, which reflects due credit on the staff for the pains taken by them. The boys seemed to be well disciplined, cheerful and healthy which adds credit to the administration and control of the Institution."

50. *Donations.*—Rs. 500 were received from the Trustees of the Sir Sassoon David Trust for boarding expenses for boys, 20 cots for the boys worth Rs. 120 were received from Mr. Rustomji R. Dalal. Both of them deserve our special thanks.

51. *Future Needs.*—The school is a new one only started since a year. In order to make it an ideal teaching institution like the Loni one, it requires to be further equipped with a Museum room, and a workshop with carpentary and smithy. There is not enough water in the well for irrigating garden crops, even though it was bored 92'. Until enough water is secured, it is not possible to demonstrate garden crops to the students. Lastly, the school is 3 miles away from Godhra town, and the road is a Katcha one and much inconvenience is experienced both by the school and visitors and specially so in the rains.

52. The following is the Balance Sheet of the School for the year 1920-21 :—

Accounts of the Godhra Agricultural School for the year 1920-21.

S. No.	Receipts.	Rs.	a.	p.	S. No.	Expenses.	Rs.	a.	p.
1	Kaira Treasury, Godhra Sub-Treasury, (Government grant) including book adjustment amounts.	7,326	5	8	1	Establishment ...	2,036	0	0
					2	Remitted to the Treasury ...	87	3	6
					3	Petty constructions and repairs including one shed of corrugated iron sheet.	293	1	9
2	Contribution from Sir Sassoon David Trust Fund.	500	0	0					
3	Sale Proceeds ...	87	3	6	4	Upkeep of Live Stock ...	547	4	5
					5	Cultivation charges including seeds, &c.	450	0	0
					6	Purchase of machinery, &c. ...	120	2	6
					7	Office expenses and miscellaneous ...	400	0	0
					8	Furniture ...	200	0	0
					9	Books ...	95	5	0
					10	Menials conservancy charges ...	236	9	0
					11	Boarding charges ...	1,790	0	0
					12	Wire fencing ...	1,225	0	0
					13	Boring ...	125	0	0
					14	Postage ...	50	0	0
					15	Travelling allowance ...	257	15	0
	Total ...	7,913	9	2		Total ...	7,913	9	2

(2) *Vernacular Agricultural Education in the Bhill Boarding School at Dohad.*

53. As stated in the last year's report (page 45), the teaching of the new classes began with 6 boys in the first year and 11 boys in the second year, from April 1920. The annual examination of these boys was held by Mr. K. B. Naik in March 1921. The results are as under:—

	No. of boys.	
	Appeared.	Passed.
First year ...	5	4
Second year ...	9	7 plus 1 passed with grace.

The examiner has remarked as follows :—

" * * * * * * * *

I am glad to report that the second year students have done well on the whole in practical agriculture, which shows that the hints given to the Agricultural Tutor have been paid attention to, but those of the first year have not fared equally well. The agricultural teacher is requested to give useful details of important crops, implements and methods of cultivation in his lectures in future. I think if the students be provided with important departmental leaflets in vernacular, they will be able to gather much useful information and a taste of reading such leaflets and magazines may be created amongst the students to their advantage."

District Work.

54. This work has been carried out by the Divisional Superintendent of Agriculture, N. D., and the District Agricultural Overseers working under him. During the year under report it was not found possible to appoint Overseers for the Surat and Ahmedabad districts, as suitable graduates were not available. However, arrangement was made to carry on the District Work in these districts through the Superintendent, Surat Farm, and the District Agricultural Overseer, Kaira.

The work under this Section is noted under the following heads:—

(1) Agricultural Shows and Demonstrations.
(2) Implement and Seed Depots.
(3) Demonstration Plots.
(4) Distribution of Seeds and Implements.
(5) Special Work.
(6) Agricultural Associations.
(7) Publication of Agricultural matters.

(1) Agricultural Shows and Demonstrations.

55. During the year under report, no big show was held in any of the districts in this Division. But ordinary Demonstrations and Lantern Shows on a small scale were held as noted below in different places and on Farms. On the Surat and Dohad Farms, parties of cultivators were called, and arrangement was made to provide them with one meal at Government cost on the Farms in order that they may be able to remain on the Farm for the whole day and attend to all operations demonstrated. A party of cultivators from Panch Mahals district was taken to Manjri Surgarcane Farm to see the Demonstration there at the expense of the District Agricultural Association, Panch Mahals. In addition to this, a party of cultivators from Kaira district was taken to Chharodi Farm to see the working of tractors and other ploughs, &c.

56. The following statement shows the places where and when Demonstrations and Shows above referred to were held in this Division:—

Place.	District.	Demonstration or Show.	Dates on which held.
Surat Farm ...	Surat ...	Party Demonstrations and Magic Lantern Shows.	7th to 20th December 1920.
Dohad Farm ...	Panch Mahals ...	Party Demonstrations ...	21st and 22nd September 1920.
Amalsad Sugarcane Farm.	Surat ..	Party Demonstrations ...	16th to 20th October 1920.
Ahwa, in the Dangs Forest.	Surat Agency ...	Demonstration and Magic Lantern Show at the time th Durbar.	12th to 15th April 1921.
Chharodi Farm ...	Ahmedabad ...	Demonstration along with Cattle Show.	26th October 1920.
Jhalod ...	Panch Mahals ...	Demonstration ...	5th November 1920.
Derol ...	Do. ...	Do. ...	21st November 1920.
Demli-Bahi ...	Do. ...	Do. ...	9th January 1921.
Anand ...	Kaira ...	Do. ...	20th February 1921.
Shukaltirth ...	Broach ...	Demonstration and Magic Lantern Show (along with the Fair).	25th and 26th November 1920.
Samni ...	Do. ...	Demonstration and Magic Lantern Show.	19th December 1920.
Jalalpur ...	Surat ...	Demonstration ...	20th to 26th February and 1st to 3rd March 1921.
Tarsada ...	Do. ...	Do. ...	27th February 1921.

The cost of all these Demonstrations came to Rs. 499-13-1. Looking to the cost incurred, the educative effects produced by these Shows and Demonstrations are very great. Cultivators from different places get an opportunity of meeting together and discussing on various problems and their difficulties are solved on the spot by the members of the department as far as possible. On the Experimental Stations they get an

opportunity of seeing the cultivation of improved method and working of different kinds of implements. The result is seen in the indents for selected seeds and improved implements received from the cultivators.

(2) *Implement and Seed Depots.*

57. In the absence of Co-operative Unions dealing in seeds, manures and implements, the department is carrying out this work by opening depots at certain central places to give facility to cultivators in purchasing their seeds, manures and implements. The Agricultural Stations in this Division do carry out this work, but in order that the less intelligent class of cultivators may have the advantage of using the improved implements and seeds at its very door, arrangements are made to engage Kamgars and ploughmen who remain in charge of the depots and go out in the surrounding villages to demonstrate the working of the ploughs and other implements.

The past experience shows that the depots work successfully in backward tracts only, as in the case of more enlightened tracts, the cultivators directly purchase the implements required and do not care to hire them from the department. These depots do not work at a profit in this Division, as has been in some places in other Divisions of the Presidency but they are continued even at a loss as it has also a very good educative effect.

58. The following table shows the working of the depots in Panch Mahals :—

Kind of Implement.	No. of days hired.	Rate of hire charges.	Amount realised.
Godhra Depot.	Days.	Rs. a. p.	Rs. a. p.
C. T. 2 Plough ...	42	0 3 0	7 14 0
B. T. 2 Plough ...	43	0 2 0	5 6 0
Malwa Ploughs ...	71	0 2 0	8 14 0
I. N. D. Hindustan Plough ...	164	0 2 0	20 8 0
Meston Ploughs ...	297	0 1 0	18 9 0
Harrows ...	14	0 1 0	0 14 0
Hoes ...	36	0 1 0	2 4 0
Total ...			64 5 0
Dohad and Jhalod Depot.			
B. T. 2 Plough ...	11	0 2 0	1 6 0
Meston Ploughs ...	80	0 1 0	5 0 0
Maiz Sheller ...	4½	0 6 0	1 11 0
Drill ...	1	0 1 0	0 1 0
Harrows and Hoes ...	7	0 1 0	0 7 0
Total ...			8 9 0
Halol Depot.			
B. T. 2 Plough ...	13	0 2 0	1 10 0
I. N. D. Plough ...	23	0 2 0	2 14 0
Meston Ploughs ...	5	0 1 0	0 5 0
Total ...			4 13 0

59. In the Ahmedabad district there were two depots in Jamiatpura and Naroda. But these were quite inactive ; while in Kaira and Broach districts the work of selling and hiring of implements was done on the Government Farms at Nadiad and Broach. In the Surat district, there is one depot at Bulsar. This is only for demonstrational purposes and does not hire out any implements. The total area tilled through this depot was 125 bighas (=71⅞ acres).

(3) *Demonstration Plots.*

60. Lands belonging to cultivators are utilized for demonstrating the improvements carried out on Farms. The result obtained on such lands convinces the cultivators of the

advantage of using improved methods of tillage and of application of profitable manures. The cost involved in carrying out this sort of work is very little. The department gives seeds and manures totally free of cost in some cases and in some cases half the cost of manure and seed is charged. During the year under report, the Divisional Representative of the Chilean Nitrate Committee, supplied Sodium Nitrate at half the cost for trial in Kaira, Panch Mahals, and Broach districts. The cultivation is carried out according to the instructions of the District Overseers or other superior members of the department. In few cases it becomes difficult to get reliable datas through ignorance of cultivators and for want of enough District Staff; but it is hoped that this difficulty will be bridged over slowly and slowly.

61. The following table shows the number of plots and area in each district worked on the above principle :—

Name of the district in which plots are situated.	No. of plots.	Area.		Remarks.
		Acres.	Gunthas.	
Surat ...	11	25	19	
Broach ...	23	30	9	
Kaira ...	70	22	38	
Panch Mahals ...	61	61	23	

The results of trials on these are recorded in the annual reports submitted by the District Agricultural Overseers, and hence they are not given here.

(4) *Distribution of Seeds and Implements.*

62. The following statement shows the distribution of different kinds of seeds and the total number of implements distributed from the Farms and Depots:—

Statement showing Distribution of Seeds and Implements from Farms and Depots during 1920-21.

Kind.	Surat Farm.	Nadiad Farm.	Dohad Farm	Broach Farm.	Depots.	Total.
Seeds.						
Jowars ...	4,064	3,808½		120	900	8,892½
Cottons ...	21,746			1,600	810¼	24,156¼
Paddy ...		45	1,753		480	2,278
Wheat ...			318		1,160	1,478
Gram ...			16¼			164¼
Maize ...			1,617½		200	1,817½
Bajri and Bhavnagari Bajro...		60			221	281
Tur ...	76	144				220
Groundnut ...	320		211½	150	10,130	10,811½
San ...		1	5,580	2,120	281	7,982
Castor seed ...		10			1,006	1,016
Vegetables ...	639½	20½	29	30	844½	1,563¾
Ginger ...	44					44
Turmeric ...	1,440					1,440
Sugarcane sets ...					15	15
Chicory ...		41				41
Lucerne seed ...				14	14	28
Other seeds ...		277¾	33	40	29	379¾
Total ...	28,329½	4,407¾	9,706¼	4,074	16,091	62,608½
Implements.						
Number ...	64	69		6	75	214
Value Rs. ...	1,033 8 0	252 4 0		125	149 15 0	1,560 11 0

In addition to this, the cotton seed distributed by the Cotton staff came to 1,744,399 lbs.

(5) *Special Work.*

63. Having seen the advantages of destroying pigs by the department, cultivators from Chikhli, Pardi, Jalalpur and Chorashi talukas of the Surat district applied to the Collector as well as to this office for taking measures for the destruction of wild pigs and

jackals which were doing a lot of serious damage to sugarcane, Suran and groundnut crops. In some cases the cultivators went to the length of stating that they would not be able to pay the assessment if this evil was not remedied. The department, thereupon, deputed Mr. T. N. Jhaveri, Entomological Assistant, with instructions to try to destroy these animals by *poisoning*, as the experience of the last year in arranging a shooting party to hunt out these creatures showed that the method was costly in proportion to the results achieved. Mr. Jhaveri undertook this work and carried it out very successfully by personally explaining the cultivators the use of this poison. He advised them to form into societies and carry out the work in co-operation. 18 such societies were formed with a total fund of about Rs. 1,000 and some 26 villages were visited for the adoption of controlling measures. During the whole operation, some 1,770 baits of poison were placed round about the crops visited by pigs and jackals. Of these 687 baits were found to have been eaten up and on enquiry it was ascertained that 90 wild pigs, 220 jackals and 5 Varans died through the effects of this poison. The poison required for the preparation of these baits was worth Rs. 30. Thus the cost per animal came to Re. 0-1-6. This does not include the cost of personal labour exerted by the cultivators in putting and removing baits as well as the cost of flour, jaggery, &c., required for preparing the baits.

Packets containing this poison with printed instructions as to how to use the poison have been now kept ready and can be obtained from the Entomological Assistant, Surat, by the societies of cultivators through the Mamlatdars of the talukas concerned. It is a matter of credit to Mr. Jhaveri that no accident to cattle or human being was reported by the use of this poison in fields. This method of killing pigs will be continued and when feasible a shooting party for hunting out these wild pigs will also be arranged for.

(6) *Agricultural Associations.*

64. The following statement shows the strength and financial condition of different Agricultural Associations in this Division. In spite of the fact that the number of members and funds at the disposal of each Association are encouraging, the zeal shown by each of these Associations for practical work is very discouraging. It has been found that with great difficulty a few meetings are being held, and that very few members take the trouble to attend these meetings:—

Serial No.	Name of Association.	Head Quarter.	No. of members.	Balance on 31-3-21.			Annual income.		
				Rs.	a.	p.	Rs.	a.	p.
1	Nadiad District ...	Nadiad ...	10	6,003	0	8	2,410	15	8
2	Panch Mahals ...	Godhra ...	368	615	13	6	163	0	9
3	Borsad Taluka ...	Borsad ...	96	90	1	0	15	0	0
4	Anand Taluka ...	Anand ...	75	750	5	5	108	4	4
5	Kapadvanj Taluka ...	Kapadvanj ...	294	112	5	0	59	0	0
6	Mehemdabad Taluka ...	Mehemdabad ...	62	199	12	0	12	0	0
7	Nadiad Taluka ...	Nadiad ...	240	390	8	0	17	11	8
8	Thasra Taluka ...	Thasra ...	234	237	0	0	20	0	0
9	Dohad Taluka ...	Dohad ...	133	420	6	11	34	0	0
10	Halol Mahal ...	Halol ...	17	482	6	6	367	14	0
11	Kalol Taluka ...	Kalol ...	33	128	0	0	54	0	0
12	Prantij Taluka ...	Prantij ...	59	232	1	8	1	0	0
13	Broach District ...	Broach ...	196	7,180	0	0	484	13	5
14	Bulsar-Pardi ...	Bulsar ...	46	396	14	5	10	8	9
	(Wound up in May 1921.)								

Out of the above Associations, the Nadiad Agricultural Association and the Broach Agricultural Associations are doing some useful work. The Nadiad Association runs a plot of ten acres, under the management of a non-graduate fieldman given by the department, from the interest of the funds at its disposal and from the grant given by the District Local Board. The utility of running this plot on the present lines through the departmental agency is under consideration, and it is hoped the question will soon be settled to the satisfaction of the Association.

The Broach Agricultural Association has not been able to keep up the zeal with which it carried out work in the commencement. However, it does a useful work in publishing the Broach Quarterly Magazine under its auspices.

(7) *Publication of Agricultural Matters.*

65. The Broach Quarterly Magazine was regularly published on the usual lines. The Divisional Superintendent of Agriculture, N. D., continued as a member on the Publishing Committee, though the Broach district has been separated from his jurisdiction. In all, 19 articles as per list attached were written by the Departmental Officers and published in this Magazine. A good deal of improvement is required to make the Magazine more useful to cultivators and it is hoped that this will be carried out in due course.

66. In addition to the contribution to this Magazine, the following members contributed articles to the Agricultural Journal of India, Pusa, on the subjects mentioned against each :—

1.	Mr. M. L. Patel, Cotton Supervisor.	Malformation in Cotton Plant leading to Sterility.	Vol. XV, Part VI, November 1920.
2.	Mr. T. N. Jhaveri, Entomological Assistant.	Swarming Caterpillars of North Gujrat.	Vol. XV, Part II, May 1920.

List of Articles written by the Members of the Agricultural Department in the Broach Quarterly Magazine during the year 1920-21.

1. Mr. G. N. Desai, Divisional Superintendent of Agriculture, N. D. :—
   - I. On Agriculture of the Broach District.
   - II. On Agriculture of Gujarat.
   - III. On Vagaries of the Season.
   - IV. On Deficiency of Agricultural Labour.
   - V. On Prevalent High Prices of Food, Grains and Fodder or High Cost of Living.
2. Mr. G. P. Pathak, District Agricultural Overseer, Broach :—
   - I. The Changes introduced in Agriculture during last 20 years and the Measures to be adopted to cope with the Same.
   - II. On use of Copper Sulphate, for checking Smut in Jowar.
   - III. On San Green Manure and Such Other Substances as Manure.
   - IV. On Sugarcane Cultivation in North Gujarat.
3. Mr. V. M. Majumdar, Graduate Assistant, Dohad Farm :—
   - I. On Urin as useful Manure.
   - II. On Berseen (a Crop for Green Fodder).
   - III. Some Informations about Agriculture in Deccan and Gujarat.
4. Mr. K. B. Naik, Superintendent, Surat Farm :—
   - I. On Relief given to Panch Mahals' Subjects in 1918-19.
   - II. Report on the Cactus Feeding Cattle Camps in Panch Mahals in the Famine of 1918-19.
5. Mr. K. D. Naik, Cotton Superintendent, Surat :—
   - I. On the Arrangement of Cotton Growing Associations of the Villages in the Surat District under the Guidance of the Agricultural Department.
6. Mr. M. L. Patel, Cotton Supervisor, Surat :—
   - I. On Cotton Improvement. A Lecture read at the Broach Agricultural Exhibition and Cattle Show.
7. Mr. P. R. Desai, District Agricultural Overseer, Panch Mahals :—
   - I. On Chilli Cultivation in the Surat District.
8. Mr. Madhusing N. Solanki, Assistant Master, Vernacular Agricultural School, Godhra :—
   - I. On How to obtain Better Prices.
9. Mr. V. G. Patel, Graduate Assistant to the Cotton Superintendent, Surat :—
   - I. Translation of an Article by Mr. Y. N. Marathe, G.B.V.C., on the Condition of Panjrapoles and Hints on Improvements of the Same.

Entomological Work.

66. Mr. T. N. Jhaveri remained in charge of Entomological Work throughout the year and carried out the research work as noted below. In addition to his Entomological Work, he gave magic lantern demonstrations and attended pig killing campaign. He made 20 Entomological and other pests demonstrations during the year at several places in the Division, partly alone and partly with the Agricultural Shows and Exhibitions. On these occasions, the lectures on typical pests of the tract were delivered together with their preventive and controlling measures and their life histories were explained with the help of magic lantern demonstrations and prepared Show Cases and Charts.

67. Investigations of granary pests and their parasites were made during the year. Principally Bruchus sp. in gram and Tur seeds, and Calandra, Rhizopertha, Tribolium, Sitotroga, and Gelechia were found in cereals. To control these, fumigation of seeds with fumes of carbon bisulphide at the rate of 1 oz. per 200 lbs. of seeds was tried. This was found to be quite successful in keeping the pest under control. In this way about 14,567 lbs. seeds of different sorts were fumigated and preserved during the year.

68. The Entomological Assistant also attended the 4th Entomological Conference held at the Agricultural Research Institute, Pusa, in February 1921. He contributed and discussed the following four papers on Economic Entomology, whose account will be published very shortly in the report of the proceedings of the Conference :—

(1) Notes on Jowar Stem-borers of Gujarat.

(2) Hairy Caterpillars (Katra) and their Control.

(3) Notes on Cotton Boll-worms.

(4) Notes on Cotton Woolly Mites and means of Control.

69. As for the experimental and research work during the year, the following investigations and trials were made :—

(1) *Katra or Hairy Caterpillars* (Amsacta Moorei).—This is a pest of the light Goradu tract of North Gujarat. On the Dohad Farm (District Panch Mahals), the moths of this species commenced to merge from their hibernating state in ground from the 17th of June 1920, after about 4·73 inches of rain had fallen, and in a period of 11 days more, 4,005 moths were caught by means of light traps. Out of these 2,585 were female moths loaded with eggs, while the rest 1,420 were males. During this period of emergence, the period of the greatest emergence was only for three days, on the 19th, 20th and 21st June 1920. On these days 1,220, 1,458 and 632 moths emerged respectively, of these the greatest numbers was of females loaded with eggs, *viz.*, 780, 984 and 423 respectively.

The result of so much successful catching of Katra moths was such, that there was a great decrease, in the appearance of Katra caterpillars in comparison with that of the last year, as well as with that of sorrounding cultivators' fields. However a small number of caterpillars appeared and entered in the Farm area. These were hand-picked or collected in a hopper's bag and destroyed. In this way about 13 lbs. of caterpillars were collected by bagging and still a greater number of young ones was killed by burying in the soil. The cost of such a treatment came to about Rs. 0-2-3 per acre.

On examining the collected worms, these were found parasitysed with Tachinid fly parasites; the eggs of which were found laid on the body and limbs of these worms.

(2) *Jowar Stem-borer.*—

(1) Chilo simplex and

(2) Sesamia inferens.

Principally these are the serious pests of Kharif Jowar crop of the Surat district. Of these "Chilo" is more serious and attacks the crop in its seedling stage, while the latter appears in the advanced stage of the crop.

This year the ravages of the first were not so severe as the Tachinid fly parasites appeared to keep them under control from the beginning of the season. The percentage of the Chilo attack in the seedling stage of the crop varied from 2 to 14 per cent. At this time the number of fly parasites in the crop was also not less. Their proportion to borers in the month of September 1920, varied from 3 to 1. While this first borer was almost annihilated by the Tachinid fly parasites and the other control measures adopted in time, the second borer, *viz.*, Sesamia began to gain ground. Its percentage of attack in the month of October varied from 7 to 10 per cent.; while on examining the stalks and stems of the harvested crop in the month of January 1921, it appeared to range from 2 to 30 per cent., and was not preyed upon and kept under the control, like the first, by the Tachinid fly parasites.

As for the control of these borers, the following measures were adopted:—.

(1) At the time of the first and second thinnings of the crop, all affected seedlings with dead hearts were removed and buried and wherever the rows were found to become gappy, by this treatment, there the shoots with dead hearts were cut back to the ground level and removed together with the borers.

(2) After the harvest of the crop, the stalks for fodder were well dried and chaffed into small pieces by means of a power chaff cutter and the stubbles in ground were dug out and burnt.

(3) Trials were made to encourage and breed out Tachinid fly parasites in the insectary and let them loose in fields to multiply and do their beneficial work of controlling "Chilo Borers".

(3) Cotton Pests.—

(1) *Boll-worm* (Earias fabia).—For controlling this pest, Bhinda (Hibiscus) esculantus) was tried as a trap crop, round about cotton fields at Dohad and Surat Farms. At Surat, the sowing of Bhinda was rather delayed; hence it did not thrive well and give the desired benefits of its trial. But at Dohad it thrived very well and successfully checked the boll-worm from going to the cotton crop. At Surat Farm, a new trial of controlling this pest by catching their moths early morning and evening while they were hovering over the crop in search of their mates, was also made, and in a period of about one month in November 1920, 182 moths were easily caught by hands from a plot of about 4 gunthas.

A further piece of investigation was done in order to know exactly whether the shedding of so much flower buds is mainly due either to (1) boll-worm attack or (2) to the climatic and other conditions. For this piece of investigation some cotton plants were selected in the plot, and every day the shedded flower buds of these plants were collected and examined for the boll-worm attack and recorded. Thus in the month of November 1920, the minimum and maximum shedding of flower buds from a plant due to the boll-worm attack varied from 11 to 27 per cent., and the average was up to 17·75 per cent.; while that due to the climatic and other conditions varied from 3 to 10 per cent. and the average was 5·5 per cent. In December 1920, the shedding from the plant due to the bollworm attack varied from 3 to 13 per cent. and the average was up to 8·5 per cent. While that due to the climatic and other condition ranged from 18 to 45 per cent., and the average was up to 27·25 per cent. In the month of January 1921, the shedding of buds due to the boll-worm attack was nil, while that due to the climatic and other factors ranged from 9 to 37 per cent., and the average was up to 21·75 per cent.

(2) *Cotton Stem-borer* (Sphenoptera gossypii).—Affected plants with borers were removed at Surat and Broach Farms and their parasites were bred out and let loose in fields. At Broach the percentage of bore attack varied from 4 to 5 per cent. in the Farm area while in the cultivators' fields it ranged up to 7 per cent. and more in some fields. The Braconid parasites were also found breeding on these worms, as many as 17 parasitic grubs were found on the body of one worm. At Surat Farm, the stem-borer attack was less, it ranged from ·25 to ·5 per cent. in some plots. To control them, 976 affected plants were uprooted and removed from an area of about 62 acres of cotton and thereafter there was no more appearance of the pest in the area.

(3) *Cotton Woolly-mites* (Eriophyes gossypii).—For controlling this pest, two measures were adopted: (1) By steeping good selected seeds of cotton in O.2 per cent. solution of mercury perchloride for about 10 minutes drying under shade and then sowing in the field; (2) By removal of affected leaves of cotton with Woolly-mites as soon as they appeared in the plot.

Germinating tests of treated seeds were also taken, which responded very well, and the treatment had no deleterious effect on the seed. It germinated up to 95 per cent. within a period of 6 days and the highest germination was on the third day of its sowing up to 76 per cent. As for the appearance of the Woolly-mites in the treated plot, it ranged up to 1·3 per cent. while in the unselected and untreated plots it went up to 3 per cent.

The removal of affected leaves with cotton Woolly-mites from the treated and untreated plots of selected seeds was done thrice at an interval of 5 to 10 days in the month of October 1920, and thereby, 461 and 418 affected leaves were picked up and removed respectively from 2 plots of about 17 gunthas each, and thereafter, there was no more appearance of the Woolly-mites in these plots.

Lastly, the yield figures of seed cotton of these two plots were also taken separately, which gave 824½ lbs. and 799 lbs. of seed cotton per acre respectively with ordinary cultural treatment and without any manure.

(4) *Surface Grass-Hoppers* (Chrotogonus trachypterous, Epacromia sp., Tryxalis sp., and Attractomorpha scabra).—The early rains of May 1920 gave rise to the occurrence of this pest on Dohad side, which began to damage the maize

and San crops in their seedling stage in the beginning of June 1920. Of these the first two species were more prevalent. For controlling them, bagging operations were resorted to, which successfully caught a very large number of these hoppers. These were so small in size so as to number 770 young ones in 1 tola. Later on these were found infested with red mites which were sticking to their limbs and antennae, and were more in case of the first species than the remaining ones. On revisiting the area after a month, no hopper was seen in that locality.

(5) *Brinjal Pest*—(Urentius echinus).—For controlling the colonies of these small tiny bugs of a dull cryptic colour, two sprayings of Incosopol No. 1 in the proportion of 4 to 6 ozs. per 4 gallons of water were given to a brinjal crop at Dohad Farm in the month of July 1920 which were quite successful in annihilating most of their colonies without any scorching effect on the foliage. About 50 gallons of the above solution, were required to spray a crop of about 10 gunthas at that time.

(6) *Tarwad Pest*—

Cotopsilia florella.
Terias hecabe.
Coreid bugs.

Tarwad plants on nearly all Farms of Gujarat were found infected with the caterpillars of the above two species of butterflies and colonies of Coreid bugs were also noticed at the Broach Farm. Even rats were found to eat germinating seeds at Dohad and Broach Farms.

As a control measure, the caterpillars were hand-picked as far as possible and then the plants were sprayed with Lead arsenate solution in the proportion of 1 oz. to 4 gallons of water. At Broach about 25 gallons of the above solution were required to spray an area of about 5 gunthas.

As for the colonies of bugs, these were hand-picked and thrown in a pot containing kerosine and water.

(7) *Ticks on Dairy Cattle at Surat Farm.*—These were controlled by scrupulously cleaning the cattle byres, and the flooring and then application of the following mixture to the cracks and crevices of the feeding troughs and byres:—

Recepie—

2 lbs. of coal tar.
½ lb. Sulphur sublime powder.
5 lbs. Linseed oil.
11 lbs. Kerosine oil.
¼ lb. Phenyle

All these were thoroughly mixed and then applied by means of a piece of rag dipped in the solution and then rubbed over all the suspected places.

To make it doubly sure, as well as to eradicate the pest completely in the resting stage, all cracks and crevices in walls as well as on stone flooring were scorched over by means of a blazing stove.

70. A large number of queries of insects and other pests from Government Farms and outside were received during the year, which were duly attended to by the Assistant Entomologist and wherever possible, the places were visited and the preventive and controlling measures were advised and tried on the spot. Besides that, collection and rearing of the typical pests of the tract and their parasites were continued during the year. The preparation of insect show cases for the district demonstrations and for the Government Farm museums was made, and the farm visitors including Government officials and cultivators, were shown and explained the typical pests of the tract, silk worms, lac, sprayers and other appliances together with suggestions of life histories and controlling measures of the pests.

71. *Measures to prevent Smut in Jowar.*—This work in the Surat district was taken up by Mr. Jhaveri in addition to his duties, whenever he had opportunities to go in villages for his magic lantern shows, &c. He demonstrated the use of copper sulphate packets in various places in the Surat district and thus distributed 2,000 packets of copper sulphate. In addition to this, the following number of packets were distributed in other districts of this Division:—

District.		No. of copper sulphate packets.
Broach	...	3,000
Kaira and Ahmedabad	...	800
Panch Mahals	...	50

Thus, the total number of packets distributed was 5,850.

72. Mr. Jhaveri has been placed this year on special duty for the investigation of pests in Jowar, and I take this opportunity of recording my appreciation of his work. He has always been found a willing and hard worker and specially so in the pig poisoning campaign, and in him the Division loses the services of a competent man.

73. *Staff.*—The staff on the Farms and in the district with very few exceptions have worked very satisfactorily. I have already remarked about the work of Messrs. M. L. Patel, K. D. Naik and T. N. Jhaveri in their respective sections, and here I might strongly urge this year the name of Mr. Khandubhai B. Naik, Superintendent, Surat Farm, to be included in the list of persons singled out for special mention. Lastly, I may mention that my Head Clerk Mr. S. H. Pandya, as usual, has worked with zeal and energy.

Surat:
5th July 1921.

BHIMBHAI M.,
Deputy Director of Agriculture, Gujarat.

APPENDIX E.

Work under the Deputy Director of Agriculture, Konkan, during the year 1920-21.

INTRODUCTORY.

Lines of Work.—The work of the year 1920-21 has proceeded and developed along the same main lines as in the past, namely:—

(1) Experimental and research work including investigations into new possibilities.

(2) Extension work or popularization and introduction of improvements into the practice of agriculturists.

(3) Agricultural education.

2. The following are the broad features of the further development during the year of the organisation for carrying out the work on the above lines.

The research work at the Karjat Rice Reasearch Station having developed a Graduate Assistant has been added to the staff of the station.

A new graduate being available to fill up the post of the Graduate Assistant on the Ratnagiri Farm, it has been possible to start work at the Hatkhamba Varkas Station in the Ratnagiri district.

The cocoanut investigations in connection with the Kumta Agricultural Station could not be taken up even during this year for want of a graduate to fill up the sanctioned post of an investigator.

The work of the Entomological section had to be suspended almost throughout the year, as Mr. Deshpande, the incumbent of the post of the Entomological Assistant was requisitioned for the Poona Agricultural College and no substitute was available.

At the intiative of the Commissioner of the Southern Division, a Demonstration Farm for East Kanara to be worked under cultivators' conditions has been projected and sanctioned by Government along with a post of a Graduate and a *Kamgar*.

The propoganda work in the Kanara district having considerably expanded, three additional posts of *Kamgars* have been sanctioned for that district while a second *Kamgar* has been also temporarily alloted to the Ratnagiri district as a trial.

It has been possible to resume propaganda work in the Kolaba district, an incumbent to fill up the vacant post having been available.

STAFF.

3. The strength of the superior technically educated staff of assistants suitable for responsible work stands as follows in comparison with that of the last year:—

	1919-20.	1920-21.
Rice Specialist and a Graduate Assistant for carrying out scientific researches in rice cultivation.	1	2
Three Experimental Stations at two each ...	6	6
Entomological Work ...	1	1
For Extension or Propaganda Work (including the new one for Mundgod Demonstration Farm).	4	5
Agricultural Schools ...	2	2
Total ...	14	16

Out of the above the Entomological post has been vacant almost throughout the year, an incumbent being available only in the last fortnight of the year; while the post of a Graduate Assistant on the Kumta Agricultural Station and another for the Mundgod Demonstration Farm are yet vacant.

The work of supervising and directing the activities of eleven independent units and of the administration work thereof scattered over four districts very badly communicated has so increased that it has been impossible for the Deputy Director alone to do adequate justice to all without the help of a superior assistant of the rank of the Divisional Superintendent. A post in the Provincial cadre was proposed but the Director of Agriculture rejected the proposal on the ground of financial strain.

It has also been found that the work greatly suffers in the leave vacancies, as there is no one available to take the place of absentees. The need for one supernumerary graduate

and one non-graduate to act as leave relievers is imperative. These were also proposed but the Director of Agriculture did not see it fit to transmit them on to Government.

Physical Conditions influencing the Agriculture of the Year.

4. The rainfall of the year was about half of the average specially along the coast, though somewhat better in the interior. Rice crops could not be transplanted timely and under optimum conditions. The coastal tract of the North Konkan had to suffer more. Somewhat even distribution however saved a total disaster. Water-content of the soil in the *rabi* season, and of the sources of water supply was considerably reduced, thus materially affecting the area and outturn of the *rabi* and irrigated crops.

The year was free from stem-borer like last year and there were no other serious insect pests. *Koleroga* on betelnut palm in Kanara was mild; the wilt disease on onions however continued in all its seriousness.

There was nothing special about the other remaining influencing factors, which are more or less of a constant nature.

The following comparative figures of the average outturns per acre of the principal crops calculated from the whole area under cultivation on the three different farms representing three different conditions for the last two years as well as for the year when the average was the highest in the history of the three farms will give a clearer idea of the combined effect of the above conditions:—

Farm and crops.	Average outturn per acre.			
	1920-21.	1919-20.	The last best year for the crop in the history of the Farm.	
			Year.	Outturn.
	lbs.	lbs.		lbs.
Alibag Farm (Kolaba district).				
Rice ...	1,452	2,437	1912-13	2,719
Nagli ...	1,039	791	1914-15	1,354
Ratnagiri Farm (Ratnagiri district).				
Rice, upland ...	1,968	2,325	1919-20	2,325
Rice, lowland ...	2,454	2,695	1919-20	2,695
Kumta Farm (Kanara district).				
Rice, upland ...	900	1,680	1919-20	1,680
Rice, lowland ...	1,650	1,900	1919-20	1,900

EXPERIMENTAL WORK.

5. For carrying out the experimental and investigation work we have now four stations as follows:—

(1) Alibag, (2) Ratnagiri, (3) Kumta and (4) Karjat Rice Research.

Some simple tests were also carried out in the districts under the immediate direction and supervision of the propaganda staff.

The most salient features of any new findings of the year are summarised below section by section, those with regard to the items which have been continued from the previous years as not being yet conclusive, which are merely in confirmation of the findings as recorded in the reports in the past not being repeated in detail.

Rice.

6. Improvement of this crop occupies a main and prominent position in the programme of work of all the four stations mentioned.

7. *Seed-bed Treatment.*—Under method of sowing, at Kumta the seedlings from sprouted seeds are this year far more superior to those obtained by starting them early under irrigation, both of which however are better than sowing in dry soil by the break of the monsoon, as in the previous year.

The other results noted under this section in the previous report are confirmed.

8. *Field Manuring.*—The green and dry leaves of jungle growth at the Kumta Farm have shown up better effects than in the past, equalling now the local manuring with farm yard manure. Green matter obtained from the crops of *dhaincha* and *san* grown on *bandhs* in the standing crop of rice at the Alibag Farm show some promise of benefit.

The results of the application of concentrated manures at Kumta are in striking corroboration of those of the previous year in all respects. Rock phosphate which showed an increase on all the farms in the previous year continues to do so at Alibag and Kumta to the same extent as last year but not at Ratnagiri in three out of the four plots. On the Ratnagiri and Alibag Farms the manurial treatments which have been discontinued and residual effects of which are watched, show generally no effect during this year except mowra refuse and rice hulls on the Alibag Farm and bone meal and salt in one of the duplicate of the upland plots on the Ratnagiri Farm.

On the Kumta Farm contrary to the experience of the previous years both salt and lime have benefited the rice crop, the increase in the case of lime amounting to 55 per cent.

9. *Cultural.*—Not ploughing the land in the hot weather at Kumta which is contrary to the common local practice of phoughing repeats the advantage in favour of former noticed in the previous year, and to an extent of 50 per cent. as against 16 of the previous year.

At Kumta the results as regards a comparison of transplanting and sowing of sprouted and dry seed once for all in the field confirm, a third year, the equality in outturn of the first and the last with less cost for the latter, and curiously enough sowing the dry seed broadcast had surpassed sowing the same by a drill by 28 per cent. On the Ratnagiri Farm on the uplands, again during this year transplanting has yielded more than the local practice of sowing sprouted seed and that too in only one out of the duplicate plots; in the low lying fields, sowing of dry seed directly in the field before the break of the monsoon has resulted into much decreased yield as compared to transplanting, while in the year 1918-19 reverse was the case which difference may be due to the sufficiency of soil moisture in 1918-19 having secured a germination long before the break of the monsoon as contrasted to its insufficiency to do so in 1920-21.

10. *Varieties.*—At Alibag, *mahadya varangal* which is a medium variety tops the list a third time again; *tulshya* and *tambadsal* closely compete with the local *bhadas*. Out of the early ones *dodki* stands first and *garisal* which was mentioned in the previous report as a good one has again proved to be so, though taking the third rank. *Kataktara*, a Bengal variety which is highly spoken of in the reports, was tried this year for the first time and has been found to take a second place. *Indrasal*, a late variety, recommended by the Bengal Department of Agriculture which was better than the local *bhadas* last year has not kept its reputation this year.

At Ratnagiri, *halva* (early) *ambemohor* has yielded much more than the local *halvi patni*.

At Kumta *muskati* and *bileakka* which were noted to be superior yielders to the local varieties have proved to be so even this year. *Bhadas* of Alibag which was a failure last year has stood first with twice as much outturn as of the local varieties, while *mot-halga*, *jiresal*, closely follow *bhadas* and are also far superior to *muskati* and *bileakka* to which latter *bilehalga* stands a little superior.

Researches into Rice Cultivation.

11. This is the second year of the working of an independent research station for rice at Karjat. Mr. K. V. Joshi, B.Ag., continued to be in the immediate charge of the studies and investigations throughout the year except from January to the end of April when he was acting as the Deputy Director of Agriculture, Konkan. One Graduate Assistant has been kept at his disposal since the beginning of the year.

Some drawbacks which were noticed in the last year's working were removed, namely, the water supply and drainage were brought under better control and many of the vitiating factors in the experimental plots were corrected or minimised as far as possible.

The end in view of these researches is to determine and if possible to define the various factors which will contribute towards obtaining a maximum yield of rice. It would be wrong to attempt the establishment of positive facts in such highly scientific work, from the data obtained in a period of two years; the results secured, however, indicate the direction in which further research should be carried and are sufficient to justify the conduct of such detailed study of the crop. Still some of the striking inferences to which the year's work has led as having a practical bearing in rice cultivation, are given below, tentative as they must be considered:—

(1) It need not be told that the yield of rice per unit area is determined by the total number of ear bearing stalks and the average weight of grain per ear head in that unit area. Some points involved in rice cultivation which have been observed to affect each one of the above two factors one way or the other are given below together with the effect produced by each :—

Names of the points and their effects on.	Number of ear bearing stalks per unit area.	Th yield per average ear-head.
(*a*) Age of seedlings at transplanting.	Increases with the increase in age.	Decreases with the increase in age.
(*b*) Vigour of seedlings ...	In not appreciably affected by a change in vigour.	Increases with the increased vigour.
(*c*) Number of culms planted per bunch the spacing being constant.	Increases with the increase in the number planted per bunch.	Decreases with the increase in the number planted per bunch.
(*d*) Space per bunch, the number per bunch being constant.	Decreases with the increase of space.	Increases with the increase of space.
(*e*) Manuring ...	Increases with manuring up to a certain limit.	Is not affected with manuring.

(2) Taking the combined effect of the two factors it is to be seen that—

(*a*) The limits of age of seedlings between which they can be transplanted to give the maximum yield are fairly wide (this was 16 to 40 days under Karjat conditions for the year 1920-1921 which nearly approximates to 18 to 34 days of the year 1919-1920) and that this period can be extended by about a week by thinner sowing of the seed-bed. The study of the situation and histology of the growing point has not helped in finding out a method of determining and defining the right stage.

(*b*) Extra vigour in seedlings as obtained by better manurial treatment does not confer a material advantage, though in one of the duplicate series some is noticeable. During last year such extra vigour had resulted into a substantial increase of 30 per cent. in the final yield. And taking the two years' results together it must be said that the point is yet mute and some other factor which is bringing about the differences must be looked for.

(*c*) A decrease in the number of seedlings to be transplanted per bunch is not made up by tillering or increased size of ear-heads and consequently a reduction in the number of seedlings is required to be accompanied by a reduction in spacing. This ratio does not however follow arithmetical progression of the different number of seedlings and is yet to be determined.

(*d*) Nitrogen and phosphoric acid given in the form of sulphate of ammonia and superphosphate respectively give some benefit to the rice crop; but the maximum increase in the yield obtained by heavy doses either singly or in a mixture of both amounted to 30 per cent. only and the increases in outturns obtained are in no way commensurate with the proportion of increases of manures. It may be inferred from this that these easily soluble forms of plant food are probably lost away in the conditions of rice growing in the Konkan.

(*e*) An increase in the number of ploughings given in preparing a puddle for transplanting has resulted into small increase in yield up to 9 ploughings.

(*f*) Rice grown by sowing dry seed once for all directly into the field, in hills (groups) of 5 to 6 seeds regularly spaced yielded equally or somewhat higher than the transplanted crop from which it might be inferred that the principle under lying transplanting seems to be more for adjusting it with the physical conditions of soil and climate and economic requirements rather than for any physiological advantages.

Profitable Crops in Place of and for Rotation with Rice.

12. *Belgaum Rice Land Jowar mixed with Rice.*—The trial of this was repeated at Malgi in the Mundgod Peta of the Kanara district but the results are not forthcoming. A systematic trial will be possible on the Mundgod Demonstration Farm to be opened.

13. *More profitable Crops in Place of Rice on the poorer Grade of Makki (up) Hands*—The trial of *ragi, vari, udid, jowar*, groundnut, sweet potato, chillies and *tur* in comparison with rice undertaken on the Kumta Farm was continued; the larger profits from *vari* and groundnut are confirmed while *ragi* has also beaten rice during this year though far from the first two; *tur* fared well, but pods being infested by insect there was no outturn to be obtained; chillies, sweet potatoes and *jowar* failed.

How to crop Rice Lands if the Season does not admit of timely Cultivation of Rice.

14. The genesis and the lines of the experiments under this have been detailed in the last report. This year's results show that—

(1) The finding of the preivous year that it is not worthwhile to attempt transplanting later than the end of August is confirmed. However the yields were reduced to 60 per cent. of the normal transplantation after the middle of July instead of middle of August in the last year.

(2) The crop sown with sprouted seed in the second week of August failed to make any growth, owing to insufficiency of rains thereafter.

(3) As regards the trial of other crops, *ambadi*, cotton, sweet potatoes, *tur*, groundnut grew fairly when planted on ridges in high-lying as well as low-lying fields; *jowar* on ridges in high-lying field did put forth ear-heads, the grains of which however were all eaten by birds. The experience gained in growing these crops in rice fields is that thorough tillage required by these crops cannot be given efficiently owing to the wet nature of the fields and thus weeds establish themselves and smother the crops.

Crops on Bandhs of Rice Fields.

15. On the Alibag Farm groundnut has been found to compete well with the local *mendhal* (dolichos sp.). The *bandhs* can also be used for growing *san* for fibre or green manure and also *dhaincha* or a permanent plantation of *rui*, for green manuring purposes.

Rabi (dry) Cropping of the Moisture Retentive Rice Fields.

16. *New Crops.*—On the Ratnagiri Farm groundnut, sweet potatoes and soy-bean which were consistently found to be suitable and more profitable than the local crops of *kulith* and *kadwa* were grown on a plot scale. Groundnut and soy-beans were eaten by hares when young. Sweet potato yielded at the rate of 5,000 lbs. per acre of tubers valued at Rs. 75 as against Rs. 20 to 30 from *kulith*. Chillies still on a row scale have established their right to be tried on a plot scale next year; *ambadi* is also found to grow well, the economical aspect of which will be determined.

Irrigation Farming.

17. *Sugarcane.*—This year's experience on the Kumta Farm leads to put Barbados at the top of all varieties tried as in the previous year; Striped Mauritius competes well with the local *daskabbu* or Red Mauritius, *manjav* has gone very low. Red Sport, Mauritius 55, and Java Hebbal were also tried on a small scale for the first time. In point of suitability for making solid gul, Barbados is the best. On the Ratnagiri Farm where Barbados was not included in the trial, Red Sport and Striped Mauritius are superior to Red Mauritius when the outturns of gul are considered.

There is nothing to add to the advantages from concentrated manures noted in the last year's report.

18. *Onion.*—Both at Ratnagiri and Kumta, this crop was infested with a wilt disease and the outturns have been very low and unremunerative. The investigations of remedial measures against the disease have been undertaken.

19. *Tobacco.*—This promises to be another remunerative irrigated new crop on the Kumta Farm.

20. *Chillies* did well as usual on the Ratnagiri Farm where planting in rows and earthing up gave less yield than the local method of indiscriminate planting in beds. On the Kumta Farm the yield was very poor though heavily manured with fish.

21. *Other New Crops.*—At Kumta, garlic did fairly well; lucerne, berseem, maize and *jowar* grown under irrigation met with failure as in previous years; potato suffered from tip wither of leaves in spite of spraying with lime sulphur wash.

Fruit Trees.

22. *Cocoanut.*—Systematic experiments in verifying the effect of salt have been undertaken in private gardens at Ratnagiri and Kumta since the year under report.

23. *New Fruit Trees.*—An experimental orchard for trying several kinds of fruit trees not commonly known in Konkan has been planned on the Kumta Farm. *Santra, mosamba* and mango grafts were planted this year.

On the Ratnagiri Farm two varieties of pine-apple, *viz.*, with spines and without spines from Ceylon have been giving fine large delicious fruits. The country *bors* (ziziphus) budded with the Nagpore kind grow so vigorously that a bearing of the Nagpore kind from the new shoots is obtained within six months after budding; the fruit does not however develop as big as in Nagpore. *Chikus* planted four years ago have begun to bear.

Varkas Land Cultivation.

24. In addition to the sub-station at Bandhan (near Alibag) which was practically the only centre so far for the investigation of the *varkas* land problems, another sub-station at Hatkhamba has been established, since the year under report, in the Ratnagiri district, a district primarily of *varkas* land cultivation occupying about four-fifths of the total cultivable area. At this new station attention is to be concentrated on the following two points to start with :—

(1) Breeding of high yielding strains of *nagli* (Eleusine coracana).

(2) The best method of foresting these lands especially the steep and stony slopes as the most profitable way of utilising them.

The work at Bandhan was continued on the same lines as noted in the previous year's report.

25. *Terracing and Levelling.*—Contrary to the past two years' experience, the yields in the terraced plots in the rectangular blocks are much less than those in the unterraced, for which no explanation except perhaps the deficiency of rain fall of the year under report can be given; in the contour terracing, the small decrease in the yield of the terraced area may be due to its natural deficiency in fertility as compared with the unterraced.

Silt catching devices of providing barriers at intervals in the drains and silt collection pits at their lowest ends have proved to be of use.

26. *Improvement of Crops suitable for Varkas Cultivation.*—In the case of *nagli* there is no residual effect of green manuring to be seen in the second year after its discontinuance; drill sowing and transplanting in furrows have this year competed well with transplanting broadcast. The yield of *nagli* has been increased by over 60 per cent. by adopting all possible improvements known.

Out of the new crops found suitable, screening groundnut with a tall growing crop like *tur* as a remedy against crows does not appear to be of much consequence. All *jowar* varieties tried yield only a small quantity of grain, though a good quantity of fodder in which respect there is not much to choose one over another. Drill sowing of hill paddy at a 9 inches distance gives as much outturn as broadcasting and as such can be used to economise the cost on weeding; manuring the hill paddy with fish and bone-meal is distinctly paying.

27. *Trial of more remunerative New Crops.*—Chillies which had done badly in the past two years resumed its position again as one of the most remunerative new crops, as in the earlier years of its trial.

Amongst others, *pavta* (*dolichos lablab*) which is usually a semi-*rabi* rice land crop gave a good yield on the *varkas* land in a trial at Devla (Ratnagiri). The preliminary tests on a small scale of a number of crops has not brought out anything striking.

28. *The most profitable Rotation of Varkas Lands.*—Suitable rotations formed out of either of the cereals *nagli*, hill paddy, *jowar*, of one of the two very remunerative crops of sweet potatoes or chillies, and of groundnut where it can be secured from the damage by crow, jackals and wild pigs are far more profitable than the usual rotation of *nagli*, *vari* and niger seed.

29. *Grasses.*—Grass seeds sown on prepared soil after it was moistened by the monsoon have consistently failed to germinate in the past. So this year, the nature's self-sowing was imitated by sowing the seeds broadcast in the fair season on the surface of the land with the result that all kinds had a very fine and normal germineration. Out of the several new grasses tried, *andropogon purpuriosericeous*, *aphidia varia* competed very well with the local grass *anthisteria ciliata*, while the perennial kinds of *penesetum cencroides*, *andropogon caricosus* are promising.

30. *Cutting out Rice Fields out of the Laterite Rock Plateux Uplands in the Ratnagiri district.*—The detailed process and cost of this together with the high outturns obtained in the first year have been described in the last year's report. The outturns of this year, that is, the second year of preparing the fields were 3,125 lbs. and 1,882 lbs. from the plots filled with good soil and with the finer debris obtained in cutting respectively.

31. *Planting of Varkas Lands with Trees and establishing a Plantation of Rui* (*calatropis gigantea*) are progressing satisfactorily, the first at Bandhan and the second on the Ratnagiri Farm.

Improvement of Fodder Supply.

32. *Cultivated Fodder Crops.*—*Shevri* (*Sesbania egyptiaca*) continued to give good results on the Ratnagiri Farm. Strangely enough lucerne which had done so well in the past four or five years on the Ratnagiri Farm fell a victim to some disease after its germination this year.

33. *Ensilage.*—*Pucca* silos have been built at Hatkhamba (Ratnagiri district) and Jambul School (Thana district) for demonstration. At Hatkhamba good silage was made at a cost of Rs. 3 per 1,000 lbs. of green grass; it was supplied to several cattle-owners of the village for trial many of whom did not seem to appreciate it yet, being altogether a new thing to them.

Improvement of Water Supply.

34. *Deep-boring.*—The bore at Hatkhamba, 10 miles east of Ratnagiri, reported in the last year's report to have reached a depth of 92 feet was carried further to a depth of 125 feet without tapping any more currents having a higher head. A second bore has also been started this year at a higher level than the first; it has gone to a depth of 132 feet having struck a spring at 100 feet capable of rising to a height of 25 feet. Below a surface layer of 40 feet of laterite, a layer of red clay throughout the remaining depth has been struck which is hampering the progress of the bore. It is proposed to carry the bores as deep as possible.

Improvement of Cattle.

35. *Use of Milk Animals for Work.*—The pair of she-buffaloes which has been kept on the Ratnagiri Farm for this purpose continued to do almost any kind of draft work of the farm. One of them which has a normal maternity worked for 196 days during the year out of which 128 days were out of her lactation period in which she gave an average daily yield of 5 lbs.

36. *Improving the Milk Breed of the Neighbourhood of the Farms.*—The letting out of the services of the *Surti* breeding buffalo bulls maintained for the purpose at all the three farms was continued. The coverings in earlier years of the Alibag Farm are now sufficiently old to enable an examination of the results on the progeny which will be undertaken and reported on next year.

Improvements in Agricultural Implements, Machinery and Appliances.

37. *Mote's Man Power Plough Ridger and Cultivator.*—This being well spoken of in the Implement and Machinery Review was ordered for trial. The make of the implement is good, but its sweep is too large to be worked by man power; it is however suitable for a Konkan pair of bullocks.

38. *The Deccan Blade Harrow for Puddling Rice.*—It was discovered by Mr. V. L. Bhoseker, Superintendent, Ratnagiri Farm, that the Deccan Blade Harrow prepares an exceedingly good puddle for rice after the land is first broken by a plough. It does two or three times as fast work as a plough which is the implement at present used for the purpose.

39. *Spike-tooth Roller for pulverising Clods for Rabi Cultivation.*—This has also been made by Mr. Bhosekar and consists in a wooden roller fitted with projecting iron spikes. It did the work of clod-crushing to some extent and it is to be seen whether perfect pulverisation could be obtained by making modifications in the size, length and distance of the spikes.

40. *Nor-cross Cultivator.*—This is a hand tool having three to five curved spikes with pointed blades at their ends. This is very useful for garden work and does three times as much work as with a weeding hook.

41. *Mac-Cormick Reaper for Harvesting Rice.*—This was tried in a place in the Mundgod Peta of the upghat portion of the Kanara district where labour has been very scarce and dear. The reaper can harvest rice provided it has not lodged or too much advanced in ripening so as to cause shedding of grain; the fields have moreover to be fairly long and wide and not too wet for the proper rolling of the wheels. Considering all these limitations there is hardly any scope for this in the rice cultivation of the Konkan.

42. *Archemedian Screw Water-lift.*—This water-lift which is recommended in Sind for small lifts was tried in Konkan for lifting water to the rice fields to a height of two to three feet from streams in case of long breaks in the rains. It was found to be more economical of labour than the *sup* or *saras* which are the lifts in local use for the purpose.

Protection of Crops from Wild Animals.

43. The wild animals most injurious to crops in Konkan, and the seriousness of the damage particularly by pigs in the Kanara district were noted in the last year's report.

44. *Pig proof Woven Wire-fence.*—In accordance with the Government Orders referred to in the last year's report demonstrations of this methods of protection based on the encouraging results of experimental work described in detail in the last year's report have been arranged at the following five places:—(1) Halga, in Karwar taluka, on behalf of a Co-operative Society, (2) Hiregutti in Kumta taluka, (3) Haigund in Honavar taluka, (4) Sirsi in Sirsi taluka and (5) Yellapur in Yellapur taluka. At some of the above places these fences have been allowed to be erected with much misgivings about its efficiency so much so that they have demanded guarantees from the department to make up the loss of the crops through inefficiency of the fence. The erection was completed late in the year so that no results of its efficiency are available for this report.

45. *Village Shikari System on Communal Basis.*—The experiment undertaken i this respect in the Honavar taluka through the Honavar Taluka Agricultural Improvement Committee, with the loan of departmental guns, and fully described in the last year's report was continued. The operations were continued in the same villages as last year and in all only 42 pigs were killed as against 150 of last year; this poor result is attributable to the slackening of the efforts on the part of the Improvement Committe. It is understood that the Collector of Kanara has permitted the extension of the system to other parts of the district.

46. *Organised Poisoning.*—This was tried through the Sirsi Taluka Agricultural Improvement Committee which purchased and distributed 5 ozs. of strychnine to 8 reliable persons. No cases of abuse came to notice.

The use of strychnine for poisoning jackals and wild cats was found to have victimised some of them in the trials in the Ratnagiri district and thus to have materially checked their depradations.

Work on Insect Pests.

47. No work could be done during the year under this section, the services of Mr. V. G. Deshpande, Entomological Assistant, being requisitioned as a lecturer at the Poona Agricultural College throughout the year and no other incumbent having been available to fill up his place.

Some Special Problems under Investigation.

48. *Manat Land Improvements.*—As regards the possibility of improving these lands by attempting to change their texture by the addition of coarse material either organic or inorganic and by drainage, no evidence is obtained during the year to revise the indefiniteness of results referred to in the last year's report.

In the direction of finding out crops to suit even the existing conditions, in addition to *shalu jowar* as a *rabi* crop and sugarcane as irrigated, cotton of the Cambodia and Dharwar American types which was grown on a field scale as semi-*rabi* crop yielded at the rate of about 250 lbs. of *kapas* per acre in spite of the fact that the germination owing to deficient soil moisture covered only about half of the area devoted, which results justify very optimistic hopes about the success of this crop. *Tur* (cajanus indicus) having given good hopes in the small trials in previous years was grown on a field scale as a semi-*rabi* crop and though the vegetative growth was that of a full crop the outturn of grains amounts to only 171 lbs. per acre. Tobacco is another crop which promises well in the first small trials given this year. Under the irrigated section, lucerne and chillies tried for the first time have proved very hopeful.

A detailed survey of the occurrence and extent of *manat* land and their position in being turned into arable lands has been undertaken.

49. *Band Disease of the Betelnut Palm in littoral Gardens of Dapoli Taluka of the Ratnagiri District.*—The first set of experiments has been brought to a close without any definite understanding of the causes or remedies of the disease though renewal of the soil at the base of the affected plants has shown some improvement.

50. *Curing of Ginger.*—No progress has been made under this as the contemplated deputation of an Assistant to visit Malbar during the year to study on the spot all the aspects and methods of curring as also cultivating and varieties suitable for the same could not be done owing to other pressing calls on his time.

51. *The Best Management of Minor Lands for the Supply of Soppu (green leaf) for Manure.*—A plan of planting the area made over to this department has been made out which will be executed as funds are made available. The Agricultural Overseer, Kanara induced some farmers of such lands to grow *Pithecolobium* plants; these have been found to be suitable and fairly quick growing reaching a height of three feet in one year.

52. *Palm Gul Manufacture.*—Making of gul from cocoanut palm is now under study; it is already taken up to some extent in Kanara since permission to do so free of excise tax was announced by Government in the year 1916. The methods of tapping and manufacture with a view to suggest improvements if any and the comparative economy of making gul versus taking a crop of nuts are under study, the results of which will be published when completed.

53. *Wilt Disease of Onion.*—This has been noticed to be getting more and more serious since the last two or three years and has arrested the extension of the crop and even threatens its being abandoned in places that have already taken to it. This has been indentified by the mycologists to be a microsporium species. This has been taken up for investigation of remedial measures. General observations of the crops at various places in the Kanara district show that poor soils and insufficient manuring show a larger incidence of damage and that climate does not seem to be a predisposing cause since crops planted at different times get affected equally. Experiments undertaken on the Kumta Farm since the year under report indicate that none of the treatments adopted, *viz.*, spraying with bordeux misture from the beginning, supplying various elements of plant food or varieties from different localities show any improvement.

54. *Other Personal Investigation by the several Members of the Staff.*—The following statement gives an abstract of the progress in the problems undertaken in the past and those taken up newly in the year under report:—

Subject.	Name of investigator.	Year of Commencement of the investigation.	Abstract of progress done.
1. Determination of the best stage of seedlings for transplanting and whether by any cultural means the lodging of a manured crop can be prevented.	Mr. V. L. Bhoseker, B.Ag., Superintendent, Ratnagiri Farm.	1918	40 to 50 days age of seedlings seems to be better than 30 to 40. No work could be done for want of time in connection with the question of lodging. As Mr. Bhoseker has now been transferred to a work where there will be no facilities for carrying on work in rice, he cannot continue the work any longer.
2. Eradication of weeds on Varkas lands.	Mr. K. B. Gujar, B.Ag., Agricultural Investigator, Alibag Farm.	1918	Studies as regards the extent of weeds of each kind, their nature of growth & life history were undertaken. Hot weather ploughing appears to reduce the weeds very considerably.
3. Investigation into the possibilities of growing san crop for fibre in Konkan without rabbing.	Do. ...	1918	After having got an indication last year that mineral superphosphate nearly equals the effect of *rab*, quantitative experiments with superphosphate were conducted with the result that 400lbs. of it appears to be near the optimum dose to produce results equal to those from burning.
4. Designing of an oven drier for drying plantains, betelnuts and cardamoms, &c.	Mr. M. R. Gokarn, B.Ag., Agricultural Overseer, Kanara.	1918	No further work could be done owing to pressure of ordinary duties.
5. How to utilise most profitably the large output of plantains fetching almost nothing at present in the betelnut gardens.	Do. ...	1918	

Needs and Difficulties of Agriculturists.

55. Though the experimental work summarised above includes some in the direction of the needs and difficulties as felt by cultivators and which they would like to get a solution for, a larger part of it refers to the items of increasing the profits from the agricultural industry on generally followed lines, the results of which are not so forceful as the solution of their own needs and difficulties. It is therefore proposed to make a record of such difficulties and needs which the various members of the staff get to know and verify by an intimate and frank talk with the cultivators. Some such that have come to notice so far are recorded below:—

(1) Arrangements to have an adequate water supply during breaks in the rains particularly in the North Konkan.

(2) Scarcity and dearness of the supply of fish and oil-cake particularly for garden crops.

(3) Arrangement to provide capital for industrial farms.

(4) Scarcity and dearness and insecurity of agricultural labour particularly felt by those who want to go in for industrial farming.

(4) Damage to crops and agricultural live stock by wild animals particularly in the Kanara district.

(5) Difficulties in getting *soppu* manure in Kanara.

(6) Difficulties in getting sufficient fodder for agricultural live stock in Kanara.

(7) *Doda* (probably an insect) disease on *vari* in the Ratnagiri district.

(8) *Manjra* (narcotic) nature of *harik* (Paspalum scrobiculatum) in the Ratnagiri district.

(9) How a good price can be fetched for mangoes in the Ratnagiri district after the steamer communication stops.

(10) A commercial use for the cashewnut fruit in the Ratnagiri district.

All of these except Nos. 7 and 8 are large problems requiring the deliberations and co-operation of other Government Departments and can only be taken up for solution as overnment can approve of and can direct and provide funds for their being taken up.

EXTENSION WORK.

56. This consists in bringing agricultural improvements to the notice and into the practice of agriculturists and giving such advice and help as will make the agricultural industry in general more profitable. This work is principally carried on through the itinerant district staff who are called Agricultural Overseers and are when necessary assisted by Kamgars. The agricultural stations also serve as standing centres of demonstration or as centres for distributing improved seed, manures and implements.

An incumbent to fill up the vacancy of the post of the Overseer for the Kolaba district was available only from 1st November 1920 of the period under report.

Three more Kamgar's posts for the Kanara district and a second one for the Ratnagiri district have been sanctioned.

POPULARISATION AND INTRODUCTION OF AGRICULTURAL IMPROVEMENTS.

57. The particular items in which work was carried on and the progress made in them during the year are reviewed below district by district.

Kanara District.

58. There was one Graduate Overseer in charge of the propaganda work in this district. The assistance of one Kamgar being found too inadequate to cope with the rapid extension and expansion of work, three more Kamgars were given to him from September last as a temporary measure and whose posts have been permanently sanctioned latterly. The aportioning of work to the four posts thus available has been done as follows :—

(1) Karwar Taluka.
(2) Ankola-Kumta.
(3) Honavar-Bhatkal.
(4) Sirsi-Yellapur.

Of course it would take some time before they would be fully useful as the raw men newly appointed need to be trained.

As a result of the availability of the Kamgars, eight more centres could be added to the seventeen of last year ; thus the list stood as follows :—

Karwar.—(1) Halge, (2) Arge, (3) Bad.

Ankola.—(4) Ankola, (5) Avarsa, (6) Andle.

Kumtha.—(7) Hegde, (8) Hiregutti, (9) Chandawar.

Honavar.—(10) Kirkee, (11) Manki, (12) Haigund.

Bhatkal.—(13) Bhatkal, (14) Murdeshwar.

Sirsi.—(15) Bandal, (16) Islur, (17) Sirsi.

Siddapur.—(18) Siddapur, (19) Killar, (20) Bilgi.

Yellapur.—(21) Malgi, (22) Mundgod, (23) Idgunji, (24) Yellapur.

Halyal.—(25) Sambrani.

The Agricultural Overseer was on tour for 230 days out of the year, during which he visited 96 villages of which 24 were new, and about 450 people were approached of whom 150 were new, besides over 300 that came in touch indirectly through the distribution operation of onion seed and Red Mauritius sugarcane.

The various items in which propaganda operations were conducted together with the progress achieved under each are summarised below :

Bone Manure for Rice.—There were eight demonstration plots as against two of last year. At all the places the results were in favour of bone manure, the response amounting to about 25 per cent. in low-lying fertile fields and as much as 50 to 75 per cent. on poorer soils. As a result of these demonstrations most of the owners of the plots and about 30 others have purchased about eight tons for use in the next season.

Maskati Variety of Rice for Uplands.—The demonstration of this was extended to four new places, at all of which it maintained its superiority over the local kinds, as noticed in the previous report. Arrangements to increase the stock of seed will be made next year.

Red Mauritius Variety of Sugarcane.—The popularization of this variety was extended in the old centres and six new centres were added during the year. Substantial progress was done during the year which is estimated at an increase of 75 acres so far as the staff of the Agricultural Department was able to know. Much rapid progress has taken place in Karwar taluka being a maiden ground in this line. About 125 new cultivators from 18 villages have used about a lac and a quarter of sets.

Other improved Varieties of Sugarcane.—Red Sport, Barbados and Manjav which have been found to be more profitable on the Sugarcane farms were tested at Sirsi and the results of the farms were confirmed. Red Sport had the tallest growth and ripened earlier than the Red Mauritius. Barbados came next and produced gul having good

crystals. The trials at two other places in the Sirsi and Siddapur talukas also corroborated the above results. The seed stock of Barbados and Red Sport has been increased for taking extensive tests.

Poona Furnace and Pans.—22 Poona furnaces were built, out of which 14 are new and the rest at old places. It was also insisted that the use of the Poona furnace only shall be the condition to getting the departmental pans on hire. It was also observed in good many cases that in spite of the introduction of the Poona pans, Poona furnaces were not built to avoid the trouble of specially building a furnace with ash pit and for want of grating; the pans were thus over-burnt at the bottom on account of the close fire with big billets of wood used as fuel, and would not certainly last very long; these defects were brought to the notice of the owners of the pans and the cultivators.

Poona furnace for local pans was demonstrated at Hiregutti (Kumta taluka) showing that economy of fuel and saving of time are effected.

As regards Poona pans, these were demonstrated at almost all the places where Poona furnace was demonstrated. At a dozen places in which they had been demonstrated before, 13 pans of the department were kept on hire in order to thoroughly implant this improvement in these localities; in all 200 people have used our pans, and a hire of Rs. 140 has been realised. The price of pans having gone down from Rs. 95, to Rs. 55, it has induced many persons to go in for purchasing Poona pans, of which 29 have been bought during the year.

In the southern part of the district and in the upghats, a number of people have their deep copper pans which they do not like to scrap and which therefore stand in the way of introducing more economic Poona pans. Whether the owners of these copper pans could be persuaded to exchange them for Poona pans is yet a mute point, but in the meantime an attempt was made to see if the existing copper pans could not be converted into the model of the Poona pan, with the result that such a conversion costs Rs. 36 for the labour of the copper-smith and about 42 lbs. worth Rs. 35 or 30—40 per cent. of the metal of the original pan has to be scrapped in the process of remodelling.

Improved Sugarcane Mills.—The Chatanooga No. 12 mill was demonstrated at two hire centres and at five other places with the mills owned by the people. There are also two or three more types of iron mills, *viz.*, Nilekani Brothers' Sirsi make, the Madras pattern introduced from Mysore side and the Poona local. The comparative advantages and disadvantages of these types were explained and advice was given from time to time for proper adjustments and small repairs. It is believed that except in a few interior villages the advantages of iron mills have now been sufficiently made known all over the district, but a necessity of a workshop near at hand for carrying out repairs within a reasonable time is being felt by the people. 8 Chatanooga mills and 6 Nilekani Brothers' mills were supplied through departmental arrangements.

There appears to be a certain scope for introducing power-crusher at one or two convenient centres along the Honavar-Gersappa and Kadra-Kodibag creeks, whence 200 to 300 acres of sugarcane can be easily commanded by the central crushing plants. Local and co-operative enterprise is being stimulated but a demonstration by the Agricultural Department would go a long way in gaining confidence of the people.

A Wider Distance between the Rows of Sugarcane.—A 3 to 3½ feet distance as against 2'—2½' of the local practice was demonstrated at four centres at all of which the crops from a wider distance have made a very good impression on the owners and a few others who saw the crops so as to bring about an extension of area with the wider distance in the centres of demonstration.

Fish Manure for Sugarcane.—This was demonstrated at three places with the same convincing results as noted in the last report. There has been a continued demand from the persons who saw the results, but the scarcity and consequent high prices of this year somewhat cooled down the enthusiasm, though manure worth Rs. 250 was sold at Karwar and Honavar.

Groundnut.—As the wild animals and other pests do not allow a margin of profit from this crop, this item no longer engages any special attention. The crop is now sufficiently known and is being grown here and there as a fancy article.

Vari.—This crop being found very successful on the Kumta Farm was taken up for popularisation. In all 150 lbs. of seed was distributed, 64 lbs. of which was distributed at Honavar amongst *Kumri* growers; at almost all places the results of the Kumta Farm were fully corroborated as could be testified by the demand for seed for next season which has arisen from those localities.

Onion.—There were in all 25 demonstration plots in 10 places where this crop is not yet known. At three places in the Karwar taluka, the people were satisfied about the prospects of this crop with the liklihood of getting more growers for next year. The operations of extending cultivation in the old centres together with the supply of seeds were continued, and 340 lbs. of seed was distributed to 400 cultivators. The fell

tip-wither disease has arrested the extension of this crop and threatens its extinction if a remedy is not found very soon. Some evidence is available to show that Goa variety may resist the disease, which will be verified by further experiments.

Manuring onion with fish was demonstrated at three places at which increased profits and a prolongation of the time of appearance of the tip-wither disease impressed the owners; the more advanced of the onion cultivators have already begun to realise the advantages of and taken to manuring onion with some concentrated form like fish.

Meston Plough.—This was demonstrated in 15 places out of which seven were new, the remaining old eight being persisted in until at least one or two cultivators at each place can be persuaded to consider the investment worth its value. The more advanced land-owning classes of cultivators, namely, *haviks* and *nadors* have been lately taking more kindly to this plough. In all 54 ploughs were sold as against 16 during the previous year.

The Improved Rice Land Puddler.—This had been under a process of evolution and trial during the last two years and has been found suitable and more economic than puddling by a plough, and has been taken up for demonstration propaganda since this year. It was demonstrated at 6 places, and its advantages were appreciated at most of them. Thirty of these have been got manufactured and kept for sale on the Kumta Farm, 4 out of which were sold during the year.

Ratnagiri District.

59. This district had one Graduate Overseer assisted by one permanent and one temporary *Kamgar*. The policy of concentrating work at a manageable number of centres easily accessible was continued. The centre of Sangameshwar was shifted to Devarukh and Sakharpa was added during the year, all the rest as mentioned in the previous report being continued; thus they stood as follows:—

Ratnagiri Taluka.—(1) Ratnagiri, (2) Hatkhamba,

Sangameshwar Taluka.—(3) Devla, (4) Sakharpa, (5) Devrukh.

Devgad Taluka.—(6) Kharepatan.

In all 32 villages were visited and about 450 cultivators were approached at the above centres, out of which 10 villages and about 100 cultivators were new. About 50 of the approached are likely to take to improved agricultural methods, 15 out of whom are the new acquisitions of the year.

The following indicates the various items of improvements on which propaganda work was carried on together with the progress achieved.

Rab Substitutes and Supplements for Rice Seed-beds.—Demonstration plots were provided at four centres where a scarcity or dearness of rab materials is felt. Best seedlings were obtained in all cases, which has made a good impression on the owners of the plots. Mr. Sabnis, the Agricultural Overseer, has found that the trouble from weeds can be minimised by ploughing the seed-beds two or three times so as to deposit the weed seeds deeper.

Field Manures for Rice.—Bone-meal, fish and *undi*-cake were continued at 6, 4 and 2 demonstration plots respectively. All the three brought about an increase of 25 to 50 per cent. in the outturn with the result that some demand has arisen for these manures at or round about the above centres.

Improvements suitable for Varkas Lands.—Green manuring of *nagli* with *san*, manuring *nagli* with fish and the new crops of *san* for fibre, sweet potatoes, chillies and guinea grass were provided for at the Devla centre. Sweet potato and chillies gave very good yields, of course with adequate manuring, and resulted into far larger net profits than any *varkas* crops grown at present. The owner is extending the cultivation of these, while sweet potato has impressed other on-lookers so much that half a dozen of them have furnished themselves with sets for growing the crop next season. The row system of cultivation of chillies and the Planet Junior hand hoe for weeding and interculturing, that were adopted, gained favour with those who saw this work. *San* grown for green manuring fell a victim to the attacks of the flea beetles and that grown for fibre being tried on *unrabbed* land was smothered with weeds. It might be now definitely assumed that there is hardly any possibility of growing *san* for fibre without *rabbing* the field. The use of fish resulted in a substantial profit which has induced two more cultivators of the same village to use this manure next year.

Extension of Sugarcane Cultivation and Introduction of Improved Methods of Cultivation and Manufacture along with it.—The scope for this has been described in the previous year's report. During the year under report 8 new persons were induced to take up sugarcane cultivation while 7 of the previous years have continued and still require guidance. Thus the area under sugarcane cultivation has increased from 6 acres of the previous year to 12 as a result of the deparment's propaganda work. The most

remarkable feature is that one demonstration plot at Devla (Sangmeshwer taluka) after two crops has induced one or two *Kulwadi* cultivators to take to this crop. All the important operations from the preparation of land to making of *gul* and the training of local workmen in these are done under the direction and supervision of trained *Kamgars*. Arrangements had also to be made to supply them with seed sets and manures for which in some cases money has been advanced by the department to be repaid out of the harvest. It is found that cultivators are still slack in following the instructions of timely manuring and tying the cane which slackness brings about some loss, and these things are being further impressed by an actual demonstration of the extent of this loss.

Sabul plough for preparing land, the Chatanooga crusher and the Poona furnace and pans were on demonstration at all the five centres of sugarcane cultivation mentioned above throughout the full period of the respective operations of gul-making and were seen by not less than 500 people. Devrukh Agricultural Association has purchased one Sabul plough for popularisation. The chief difficulty for using the Sabul plough is the poor condition of draft animals, of which two pairs, preferably of buffaloes, are required; many people are afraid to use their animals to this plough as they fear that their animals would die of heart-failure. As a result of our demonstrations the demand for Chatanooga mill on hire is increasing and along the Vijayardrug creek a private gentleman who had stocked a mill and pans for hire has doubled his stock and the Kharepatan Co-operative Credit Society has been induced to establish a Co-operative Implement Hire Society for these and other improved implements.

Introduction of Onion, Lucerne and Sweet Potatoes.—Owing to the onion seed obtained from four different places not having germinated, there are no results to report. Lucerne also met an adverse fate due to fungus disease in its early stage at both the places it was tried. Sweet potato was grown at Ratnagiri and the large yields obtained have very much fascinated the owner.

Meston Plough.—This was demonstrated at four places for a sufficiently long period. In the opinion of the cultivators there is no striking advantage over the country plough, while it draws heavier.

Bulsar Rahat (Noria water-lift) and Mot.—One Bulsar Rahat has been fixed for demonstration on a river side where it will be worked for one full season. Three cultivators at and near Devrukh were persuaded to use *mots* which appear more suitable for individual small holders and for smaller water supply most prevalent in this district.

Besides carrying out the above propaganda work which forms the principal activity of the district staff, the Agricultural Overseer was in immediate charge of the departmental arrangements of the Mango Show at Ratnagiri, and also had his share in those of the Dahanu Agricultural Exhibition, and in the demonstrations to parties of cultivators on the Ratnagiri Farm, all of which occupied not less than two months of his time.

Kolaba District.

60. A graduate was available to fill up the vacancy of the Agricultural Overseer of the district from 1st November 1920, but his services had to be kept at the disposal of the Deputy Director of Animal Breeding for famine work from the 15th of February 1921; thus he was available for Kolaba District Work for only three and a half months. This time was used chiefly in the following manner:

Survey of the Patalganga and Ulhas river tracts.—A detailed survey of the Patalganga and the Ulhas river tracts carrying a permanent supply of water from the Tata Hydroelectric Works at Campoli and Bhivpuri respectively with a view to investigate into the possibilities of utilising the water for growing garden crops, occupied the greater portion of the time. The water supply and the soil are eminently suitable for irrigation farming on the peasantry system. Most of the land is however owned by landlords who seldom cultivating it themselves look upon this venture with diffidence, while the tenants who are temporary and of poor means possess too little imagination, enterprise, and capital to take it up merely as a result of precept. It is, however, thought that an actual example by way of a Demonstration Farm in that locality would help to rouse both the classes to understand the large benefit to be accrued from the exploitation of this water facility.

Introduction of Improvements in the present Irrigation Farming.—This was done in five to six villages in the Panwel and Kalyan talukas having some garden cultivation; sulphate of ammonia in place of fish manure which has been scarce and dear and systematic plantation of chillies on ridges were the items advocated. Four persons adopted sulphate of ammonia for their sugarcane plot, and two persons have adopted sugarcane newly.

Thana District.

61. There was one Graduate Overseer assisted by one Kamgar. The Overseer toured for 223 days and both of them together visited in all 31 villages. In all 47 agriculturists were approached 12 out of whom were new. 20 of the total and 4 to 5 of the new are likely to adopt improved practices brought to their notice.

The progress made in the principal items of work is represented by the following:

Bringing the Immensity of Scope and Facilities for profitably developing Garden cultivation to the Notice of the Land Owners and interesting them to take up to Cultivation.—Ten new land owners were approached, but none seems to be yet sufficiently convinced to actually undertake any scheme.

Introduction of Improvements in the present Methods of Garden Cultivation.—Use of more efficient ploughs such as Sabul and the like and of harrow to bring about better and cheap preparatory tillage and ridge and row method of planting, saving of labour and water, use of Bulsar Rahat as a more economic water lift, an increase in the yield and profits by the employment of interculturing implements and recommendation of new and more profitable crops in garden cultivation are included under this. A few new persons were approached and all of them have appreciated the improved methods advocated. One gardener was induced for the first time to cultivate ginger, the results of which convinced him of the profitableness of the crop, and it is likely that this would serve as an example to others to take to this crop. About half a dozen people have adopted the system of clean tillage in fruit gardens of *chiku*, mangoes, and cocoanuts and two of them grew green manure crops also. As a result of demonstrating the large profits from the systematic plantation of sugarcane at Sanjan, four more cultivators have promised to grow cane on improved lines. The grape-vines which are found growing in a few places are never properly managed; at two places they were properly pruned and the owners were astonished to find their vines bearing which was never the case before. A small party of *mukadams* of large landed proprietors was taken round to the typical garden crop farm of Mr. Sakharam Patil of Nandore near Palghar.

$2\frac{3}{4}$ tons of bone meal and 2 Kirlosker's ploughs were supplied.

Demonstration of Improvements in the rice, varkas land and manat land Farming.—About 75 substantial agriculturists from the various talukas of the Thana district were taken to the Alibag Farm for this purpose.

An agricultural exhibition accompanied by comprehensive series of demonstrations and discourses was held at Dahanu which also proved of great value in stimulating interest in the improved methods of agriculture.

Exhibitions, Demonstrations and Shows.

62. A general agricultural exhibition at Dahanu for the Thana district and a Mango Show at Ratnagiri for the Ratnagiri district accompanied by comprehensive programmes of demonstrations and discourses were held during the year. Both of them were largely attended and have created a good deal of interest. Amongst the exhibits an improved hay-press at Dahanu and an improved mango packing basket at Ratnagiri are worth special mention.

63. Besides the large number of small local demonstrations that were given by the Agricultural Overseers in connection with the propaganda work in the districts, large demonstrations to show the several improvements in actual operation on the Government Farms were organised by calling parties of cultivators from the districts, at all the three Farms—Alibag, Ratnagiri and Kumta—for cultivators from localities mentioned below against each—

Alibag.—All talukas of Thana district. Attendance was evenly distributed from all talukas.

Ratnagiri.—Dapoli, Khed, Chiploon talukas and Mandangad and Guhagar petas of the Ratnagiri district out of which Chiploon contributed more than half.

Kumta.—The coastal taluka of Kumta, Karwar, Ankola, Honavar and Bhatkal peta of the Kanara district out of which Kumta contributed three-fourths of the total attendance, Honavar, though very close, contributing only one.

The total number of visitors at each place was arranged to be limited to 100. At least outwardly considerable interest and appreciation on the part of the visitors was to be noticed, though the real test would be to know how many of them actually adopt any of the improvements they saw.

Supply of Implements, Manure, Seeds and other articles to Order.

64. In order to meet the orders which were created as a result of propaganda work all the three agricultural stations were made the principal agencies for obtaining and

distributing the necessary articles until Co-operative Societies and private agencies think it worthwhile to take it up. The following statement represents the business of the year :—

Kind of Article.		Alibag Farm.	Ratnagiri Farm.	Kumta Farm.	Arranged to be supplied direct from dealers without the intervention of the Farms.	Total.
Seeds.						
Castor	lbs.	90				90
Cocoanuts	No.				112	112
Groundnut	lbs.	23	106	600	556	1,285
Jowar	„	30			40	70
Onions seed	„			295	180	475
Rice	„	7,743	12,693	850	40	21,326
Rice seedlings (bundles).	„	10,102				10,102
San	„	73				73
Shevari	„		12		6	18
Sugarcane sets	„	5,020			230,000	235,020
Sweet potato vines	„		Worth Rs. 15 sufficient for half acre.			
Potato seed	„				42	42
Tur	„	27				27
Maiz	„				200	200
Vari	„			150		150
Bamboo seed	„				10	10
Vegetable seeds including foreign seeds.	„		3¾		Rs. 10	
Mango grafts	„				125	125
Manures.						
Ammonium sulphate	lbs.	560	46		400	1,056
Bone-meal	„	18,885	265	16,600	20,160	55,910
Fish manure	„	15,785	8,504	3,650	54,880	82,819
Implements.						
Planet junior Handhoe	No.				2	2
Gujrath Khurpi	„	2			1	3
Gul Pans	„			22	9	31
Iron Mots	„				3	3
Iron scrapers	„	2				2
Meston ploughs	„	2	3	54	12	71
Madras plough	„	5				5
B. T2 Plough	„				2	2
Sindhi plough	„	1				1
Sugarcane crusher	„			2	12	14
Chaff cutter	„				1	1
W. K. S. ploughs	„	5				5
Sabul plough	„				2	2
Tooth cultivator					4	4
Cattle food.						
Decorticated cotton seed cake as cattle food.	lbs.		15,206			15,206

Denaturalised Salt for Manure.—The arrangements to supply denaturalised salt for manurial puposes duty-free was continued. The number of permits issued together with the total quantity of salt for each district during the year under report is given in the following statement :—

	Thana.	Kolaba.	Ratnagiri.	Kanara.	Total.
Number of permits ...	12	7	45	63	127
Quantity in Bengal maunds.	362	120	703	637	1,822

Visitors and Agricultural Advice by Correspondence.

65. In addition to a large number of enquiries received and dealt with on the spot by the propaganda staff in course of their tours, the following statement shows the number of visitors (besides the special parties arranged) and those from schools and Training Colleges and enquiries by correspondence for agricultural advice received and dealt with during the year under report by the various agricultural institutions and officers :—

Name of institution or Officer.	No. of visitors.	No. of enquiries dealt with by correspondence.
Deputy Director of Agriculture ...	25	62
Rice Specialist ...		
Entomological Assistant ...		
Agricultural Overseer, Thana ...		80
Do. do. Ratnagiri ...	156	44
Do. do. Kolaba ...		
Do. do. Kanara ...	125	45
Alibag Farm ...	169	65
Ratnagiri Farm ...	156	44
Kumta Farm ...	123	24
Jambul Agricultural School ...	52	
Lord Willingdon Agricultural School, Alibag.	81	9
Total ...	887	323

Publications.

66. The reports of four years' experimental work of the three agricultural stations—Alibag, Ratnagiri and Kumta—the printing of which was withheld during the war were prepared and sent for publication.

Notes and articles were contributed to the various agricultural magazines by the members of the staff of which the principal ones are mentioned below:—

	Name of the author.	Where published.
(1) Monthly notes of agricultural operations for each of the four districts.	Deputy Director of Agriculture, Konkan, assisted by the Farm Superintendents and Agricultural Overseers.	Shetki and Shetkari and Konkan Sheti Samachar and Vakkaliganoo Vakkalatanavoo.
(2) Agricultural improvements under demonstration on the Ratnagiri Farm.	Mr. V. L. Bhosekar, Superintendent, Ratnagiri Farm.	Separate book-let.
(3) Do. on the Kumta Farm.	Mr. V. S. Habbu, Superintendent, Kumta Farm.	Do.
(4) Do. on the Alibag Farm.	Mr. G. B. Pandit, Superintendent, Alibag Farm and Mr. K. B. Gujar, Agricultural Investigator, Alibag Farm.	Do.
(5) Account of studies in rice in three series of articles.	Mr. K. V. Joshi, B.Ag., Rice Specialist, Karjat.	Poona Agricultural College Magazine.
(6) Cultivation of sugarcane as a dry crop in Kolaba district.	Mr. J. N. Purandare, B.Ag., Head Master, Vernacular Agricultural School, Jambul.	Do. in English and in Shetki and Shetkari Monthly Magazine in Marathi.
(7) Melon as a dry rabi crop in Kolaba district.	Do. do.	Do. do.
(8) Effect of common salt on the formation of cabbage heads.	Mr. V. R. Sabnis, B.Ag., Agricultural Overseer, Ratnagiri.	Poona Agricultural College Magazine.
(9) Use of Gujrat harrow for ridge planting.	Mr. G. K. Patil, Kamgar, Thana district.	Shetki and Shetkari.
(10) Red Mauritius sugarcane cultivation.	Mr. M. R. Gokarn, B.Ag., Agricultural Overseer, Kanara.	Vkkaliganoo Vakkalatanavoo at Dharwar.
(11) Poona furnance and improvement in gul making.	Do. do.	Do. do.
(12) Cocoanut beetles and their remedies.	Do. do.	Do. do.
(13) Rat proof tin caps for cocoanut ...	Do. do.	Do. do.
(14) Kirlosker's Konkan plough ...	Do. do.	Do. do.

The Konkan Agricultural Magazine.—The monthly magazine in Marathi devoted exclusively to Konkan agriculture under the name Konkan Sheti Samachar conducted by Mr. Y. G. Gurjar of Alibag under the advice of the Konkan Agricultural Department has been almost lifeless, only 3 issues being published during the year as Mr. Gurjar seems to have become very indifferent towards it. Arrangement to have one published regularly is being considered.

Agricultural Associations.

67. All the eleven Associations continued to be on the list though most of them are defunct and with the exception of Ratnagiri district and Mahim (Thana district) have not even responded to the call for their reports of activities. In the Kanara district, the Taluka and the Firka (a group of villages under one Shanbhag) Food Production Committees have been transformed into permanent institutions for carrying on the work of agricultural improvement under the name of the Agricultural Improvement Committees under the supervision of the Agricultural Department.

The Ratnagiri District Agricultural Association continued to strive through its taluka branches to have some work done. It has employed an organiser to assist the taluka branches in forming and carrying out their respective programmes but it was found that the field is too large for one man to produce any tangible results. A Mango Show and Conference was held during the year under its auspices. Dapoli, Khed and Ratnagiri taluka branches popularised bone-meal and the Sangameshwar branch purchased a set of improved appliances for sugarcane cultivation for being demonstrated. The remaining talukas did nothing. No one of those responsible for the working of the branches seems to devote sufficient interest required for systematic work. The funds of the Association are too scanty to maintain an organiser, but the Director of Agriculture having sanctioned to pay the organiser from departmental funds for one year he has been continued and attached entirely to the Chiploon taluka branch which promised to utilise his services to the fullest possible advantage.

The Agricultural Improvement Committees in the Kanara district were empowered by the Collector to organise village *shikari* system on a communal basis for killing wild pigs and members of the Firka Committee were accepted to be the approved authorities under whom drives and beats after wild pigs in the forest may be carried on. Siddapur and Kumta talukas and Mundgod peta only have reported the number of pigs thus killed in one way or another to be 74 (up to March 1921), 61 (up to December 1920) and 143 (up to November 1920) respectively. No reports from the above talukas after the months mentioned against them and from the remaining talukas were received. No reports of having done any other work of introducing agricultural improvements have been received from any of the talukas.

The remaining Agricultural Associations have not reported any work.

AGRICULTURAL EDUCATION.

68. Both the vernacular (Marathi) Agricultural Schools,

(1) Jambul, taluka Kalyan, district Thana,

(2) Lord Willingdon Agricultural School at Alibag, district Kolaba,

continued to be run during the year.

69. *Studentship and Progress.*—The standard for admission in respect of age or educational qualifications has remained the same as in the previous year. The total number of boys in the two schools at the end of the last school year was as follows:—

Name of School.	1st year.	2nd year.	Total.	Remarks.
Jambul School ...	13	6	19	In all 18 applications were received all of whom being eligible were admitted but only 15 actually joined the school, 2 out of whom left the school owing to ill health. In the second year out of 8 promoted one was allowed to join Loni School at his request and one more was absent almost throughout the year owing to illness.
Lord Willingdon Agricultural School, Alibag.	5	7	12	In all 16 applications were received out of whom 9 were admitted. All had joined in the beginning but 4 students left the school as they did not like to work in the field.

These were derived from the following districts:—

Names of School.	Thana—Bombay.	Kolaba including Janjira State.	Ratnagiri.	Outside Konkan.	Total.
Jambul ...	11	3	1	4	19
Alibag ...		8	4		12

Arranged according to caste they stand as follows :—

Caste.	Jambul.	Alibag.
Marathas ...	3	
Agri ...	1	
Brahmins ...	14	10
Prabhus ...		2
Goud Saraswat ...	1	
Total ...	19	12

The number of fresh students at Jambul show a slight improvement over last year. They are however short by 7 at Jambul and by 15 at Alibag of the maximum 20 which each of the two schools provides for.

The new admissions also do not show any improvement in the situations explained in the last year's report with regard to larger farming communities of Marathas and Agris contributing an adequate quota.

There has been no change in the curriculum during the year. The pumping plant on the riverside at Jambul having been erected during the year, garden crops could be included in the programme of practical work, which interested the students very much. The students at the Alibag School were also given their lessons in oil engine at Jambul.

The boys can very soon be interested to appreciate the somewhat different method of instruction and to take to practical work with readiness and zeal.

The boys were examined at the end of the school year in April 1921 with the following result:—

Name of School and class.	No. of students that appeared for the examination.	No. of students that passed in all the subjects.	Remarks showing the degree of proficiency in general.
Jambul.			
Second year ...	6	6	Agriculture and nature study poor to fair. Practical agriculture and workshop practice very good. Other subsidiary subjects good.
First year ...	13	9	Agriculture and nature study poor to fair. Practical agriculture bad to good. Workshop practice very good. Other subsidiary subjects good to very good.
Alibag.			
Second year ...	6	5	Fair in agriculture and nature study both theoretical and practical and also in subjects of subsidiary importance. Good in workshop practice. Poor in rural life and sanitation.
First year ...	5	5	Poor in agriculture theory; good in practical agriculture and nature study. Very poor in rural life and sanitation and agricultural geography, good in arithmetic and workshop practice, fair in language.

The examiners—Mr. S. G. Bhalerao, Graduate Assistant, Rice Plant Breeding Station, Karjat and Mr. K. B. Gujar, Agricultural Investigator, Alibag Agricultural Station, in a joint report make the following observations and suggestions:—

(1) Study of language should be of an extensive nature and not confined to text books.

(2) Highly appreciate the courses in smithy and carpentry work.

(3) Examinations should consist of very little written answers but should consist in principally summing up a student's work in an inspection of his records and note books and in the impressions of the teaching staff.

(4) The students are made up of at least two distinctly different types, namely, of a very low and a very high calibre. For the very low, they recommend compartmental examination and for the very high, a post certificate apprenticeship in business farming on improved lines.

70. *Cost of Education.*—The total expenditure at the Schools classified under the several important sub-heads was as follows:—

	Jambul School.	Lord Willingdon Agricultural School, Alibag.
	Rs.	Rs.
Recurring.		
Teaching Establishment (including the mechanic) ...	2,748	2,923
Travelling Allowance to Establishment ...	619	334
Stationery and materials for teaching in the workshop and tour of students ...	337	98
School Farm including upkeep of live stock ...	1,792	1,278
Maintenance charges for students (including medical attendance) ...	3,634	2,751
Office expenses (including postage and telegrams) ...	503	258
Total, recurring ...	9,633	7,642
Non-Recurring.		
Permanent buildings and structures ...	8,456	560
Purchase of teaching apparatus and equipment ...	214	269
Purchase of dead stock (including school furniture boarding utensils and storage equipment, Farm implements and workshop equipment).	1,260	393
Purchase of live stock ...		66
Temporary structures ...	78	
Permanent improvements, such as drainage and levelling, construction of well, Farm road and fence.	4,923	1,002
Total, non-recurring ...	9,931	2,290
Grand Total ...	19,564	9,932
Value of the School Farm produce used for the School boarding ...	747	16

Out of the above, Rs. 500 out of the expenses for the boarding charges of each were granted from the Sir Sasoon David Trust Fund, the remaining being met from the public funds.

Receipts actually credited into Government treasury were as follows:—

	Jambul.	Alibag.
Sale proceeds of the School produce ...	586	390
Proceeds from Mr. Pisal's Land Trust ...	1,856	
Contributions from the District Local Boards ...	504	
Total ...	2,946	390

71. *Further Developments.*—At the Jambul School the erection of a pumping plant on the riverside was completed early in the year. This made it possible to undertake irrigation farming in the programme of practical work of the students which interested the boys very much. The block of land between the school buildings and the riverside has been by exchange brought under the ownership of the Pisal's Land Trust which in its turn has given the control of its management to the School. All this block was wire-fenced, thus safe-guarding the crops in the fair season from the menace of stray cattle, and has also been traversed by a *kacha* road across its middle. A building for a workshop is the most primary need in order to remove the great disability in making the instructions in this important subject quite efficient. Some additions and alterations to the boarding house, a second class room, a gymnasium, implement shed and additional servants' quarters are also required.

The Alibag School had to continue even this year without its complete equipment of buildings as the grant for the same was surrendered. The students and the staff were therefore continued to be accommodated in the private bungalows close by of Sirdar P. K. Biwalkar and Rao Bahadur G. M. Kamat of Alibag who continued their public spirited generosity even during this year. Further, as the school is not attracting an adequate number of boys, Government have desired that any investment in permanent buildings should be held in abeyance pending further experience about the necessity of continuing the school after making vigorous efforts to make the school known to the fullest possible extent in the locality which it is intended to serve. The school is, however, in the present arrangements, working under great inconvenience and disabilities particularly in regard to the workshop instructions.

72. *Public Opinion about this Form of Vernacular Agricultural Education.*—Out of 27 students turned out from the Jambul School uptil now, five have been managing their own lands, two have gone in the service of the Agricultural Department, one is continuing a further training in horticulture, eight are continuing their secondary education further, seven have not yet settled and whereabouts of four are not known. The age at which the students are turned out from the agricultural schools is perhaps too tender and the knowledge gained too general to make an impression on their parents about the boy's ability to profit them by the education received; it is therefore thought that a continuation course of apprenticeship for two years more in some definite branch of farming would be desirable.

The year's experience has not brought any new facts over those mentioned in the last year's report about the opinion and attitude of the public towards this form of Vernacular Agricultural Education. The contemplated and continuous vigorous propaganda extending over a larger period in the year by a special staff could not be carried out for want of a suitable man.

PERSONAL.

73. The charge of the Division was held by the undersigned throughout the year excepting four months from January to April, when he was on privilege leave, during which Mr. K. V. Joshi, Rice Specialist, acted.

The following graduates were newly entertained in the posts mentioned against each :—

Name of person.	Name of Post.	From what month appointed.
1 Mr. M. V. Gadkari, B.Ag. ...	Newly created post of Graduate Assistant to the Rice Specialist, Karjat.	July 1920.
2 Mr. N. V. Hanmante, B.Ag. ...	Vacant post of Agricultural Overseer, Kolaba.	November 1920.
3 Mr. V. K. Patankar, B.Ag. ...	Vacant post of Graduate Assistant on the Ratnagiri Farm.	August 1920.
4 Mr. S. S. Wagh, B.Ag. ...	Vacant post of Graduate Assistant on the Kumta Farm.	June 1921.
5 Mr. P. V. Wagle, B.Ag. ...	Vacant post of the Entomological Assistant, Konkan.	June 1921.

Thus all the sanctioned posts of the Division were full only by the end of the year under report. There were no material changes in the personnel of the remaining staff.

All the superior staff with the exception of one or two have exerted to put in a hard and sincere work to the best of their respective abilities.

The patience of the members of both the Upper and Lower Subordinate services in awaiting the long overdue revisions in their scales of pay and prospects is almost exhausting and signs of great restlessness are visible.

V. G. GOKHALE,
Deputy Director of Agriculture, Konkan.

APPENDIX F.

Annual Report of the Deputy Director of Agriculture, Sind, 1920-21.

ORGANIZATION.

1. The Imperial Agricultural Service is represented by one Officer—the Deputy Director of Agriculture. There has been no change in this respect for the last 15 years.

The Provincial Agricultural Service is also represented by one Officer—the Divisional Superintendent of Agriculture. There has been no change in this respect for the last nine years.

The Upper Subordinate Agricultural Service has been gradually built up since 1907 and at the end of the year under report the cadre included 13 men in the grades tabulated below :—

Grade.	Strength in numbers.	Scale of Salary in Rupees per mensem.
		Rs.
I	Nil	250
II	Nil	175-10-225
III	4	110-8-150
IV	7	75-5-100
Probation for one year.	2	60

The Lower Subordinate Agricultural Service has been gradually built up since 1905 and at the end of the year under report the cadre included 14 men in the grades tabulated below :—

Grade.	Strength in numbers.	Scale of Salary in Rupees per mensem.
		Rs.
I	2	50-2-60
II	4	35-2-45
III	7	20-2-30
Special ...	1	75-5-100

The qualification for the Upper Subordinate Service is the degree conferred by the Bombay or Lahore Universities upon men educated at the Poona or Lyallpur Agricultural Colleges.

The qualification for the Lower Subordinate Service was not hitherto specified but has now been fixed as the Lyallpur Certificate conferred on successful candidates examined after a two-year course at that College.

2. The present organization of the Agricultural Department in Sind as described above is about on par with what existed in the Presidency proper in the Nineties of the last century before Lord Curzon created the Department of Agriculture in India as now constituted. During the last decade and a half the Agricultural Departments in all the Provinces of India have been built up and now most provinces have fairly strong organizations, notably Madras. During this period of rapid development Sind has practically been neglected. Her crops have not yet been tackled by a Botanist; her soils (with special reference to Kalar) have been temporarily studied for a period of six months by a Chemist on deputation; she suffers intense damage from insect pests but no Entomologist has ever set foot within her borders; a Subordinate Mycologist has occasionally paid flying visits to investigate her plant diseases; she has many pressing Agricultural Engineering problems, but the Agricultural Engineer has his hands more than full in the Presidency proper, and can only pay a visit at long intervals for a few days.

On the other hand the Public have turned restive and have expressed their lack of appreciation for the Department. Nevertheless it is hoped that considerable achievements will be revealed in the following paragraphs justifying the claim that material progress has been made.

Mirpurkhas Experimental Farm.
Do. Seed Farm.
Landhi Experimental Farm.
Larkhana Experimental Farm.
Sukkur Dairy Farm.
Jacobabad Seed Farm.

3. The Province is now fairly well equipped with Farms as noted in the margin.

The great money crops are represented as follows:—

Rice at Larkhana.

Wheat at Jacobabad.

Cotton at Mirpurkhas.

Oil seeds have not yet been taken in hand but Jacobabad would be a very suitable centre for the study of this important crop.

Fruit is receiving special attention at Mirpurkhas and to a less extent at Landhi where fodders and vegetables (specially the potato crop) are the main problems.

Rice work at Larkhana has been greatly hampered owing to irrigation difficulties—the Farm depending upon a zamindari canal—but a direct supply channel from the Ghar Canal has just been completed.

The Jacobabad Farm is in process of being laid out. The site is a good one but there has been a great deal of work involved in clearing the forest growth and levelling the surface. No buildings have yet been constructed.

Kathar in Hyderabad District.
Jamesabad in Thar Parkar District.
Nawabshah in Nawabshah District.
Shikarpur in Sukkur District.
Kambar in Larkhana District.

In addition to these Farms there were five Sub-Stations, at the marginally noted centres where the object is to demonstrate improvements worked out at Experimental Farms.

The Agricultural School at Mirpurkhas was run on the same lines as usual. No orders have yet been issued by Government upon the proposed establishment of two Substantial Agricultural Schools for Sind.

An Officer of the Upper Subordinate Service (Mr. Thadani) was raised to Provincial rank on his deputation in December, for a year, to Taxas, United States of America, to study Plant Breeding.

He will specialize on cotton on his return to Sind.

4. The budget of the department in Sind for the year 1920-21 was as follows:—

		Rs.	a.	p.
Salaries	...	44,748	0	0
Capital Expenditure	...	25,077	3	11
Recurrent Expenditure	...	1,17,697	12	0
Total	...	1,87,522	15	11

And, in addition, Rs. 20,000 were transferred to the P. W. D. for construction of Jacobabad Farm Buildings but this sum lapsed.

Season.

5. The Kharif season was fairly satisfactory until the latter part of August when there was a sudden and unexpected fall in the River which never recovered. This adversely reacted upon the maturing of the Kharif crops and greatly reduced outturns, as well as affecting quality of produce. Any late sown crops practically failed. Nevertheless Sind produced a lakh of bales of cotton but this would probably have been $1\frac{1}{2}$ to 2 lakhs, had the season ended well.

The failure of the River in August practically guaranteed a poor Rabi Season and this was accentuated by the absence of Rabi rains and the early arrival of hot winds. On the Jamrao area there was no wheat owing to the mouth of the Nara Supply Channel at Rohri becoming silted up through the River slightly changing its course. In recent years the area under wheat in Sind excluding Khairpur State has touched 6 lakhs of acres with an outturn of $2\frac{1}{4}$ lakhs of tons of grain or about 3 acres per ton. In the year under report the area touched $3\frac{1}{5}$ lakhs of acres with a yield of $\frac{9}{10}$ths of a lakh of tons of grain, hence the average yield per acre was approximately three-quarters of normal.

Rabi oil-seeds were similarly affected as regards area which fell to half of last year's figure of over 2 lakhs of acres. The yield per acre however was approximately the same as that of last year's—about 12 acres to the ton.

Damage from insect pests and other diseases was not considerable. Frost did some damage to early wheat in the North of Sind.

Fodder was very scarce and reached high prices all over Sind. Jowar Kirbi is now (May 1921) commanding a price of nearly 3 rupees per Bengal Maund in Sukkur district.

On the Jamrao-Mithrao areas where there was no Rabi water the livestock have been famished and the condition of the babul trees, the ultimate stand-by of all kinds of stock, is perhaps a good index of the state of things. The absence of rain in recent years has affected the wells and good and sufficient drinking water for stock and man is conspicuous by its absence in any parts of Sind, no doubt indirectly accounting along with the fodder shortage, for much of the epidemic disease which has prevailed.

6. The cotton market opened at about Rs. 12 per maund of seed cotton and fell to Rs. 8 towards the end of the season thus causing great loss to many zamindars who held on the hope of a rise.

During the closing days of the Calendar year 1920 American Cotton at Liverpool touched the lowest point reached up to that date since August 1916, when "spot" fell below 10*d*. Early in 1920 the price of "spot" exceeded 32*d*. This gives some idea of the sensational slump in the price of cotton, which occurred in 1920.

It is of interest to note here a new system of purchasing cotton introduced by Messrs. Ralli Brothers in the past season. This is called the "45 Day System" which enables a cultivator to deliver his seed cotton and receive an advance upon it, and leaves him at..... liberty to fix the selling price any time he likes during the succeeding period of 45 days, at the current rate of the day selected. On a rising market he stands to gain and on a falling market to lose. The object of this system is to enable the Firm to compete with dealers who advance money to zamindars on the security of their cotton.

Owing to the poor monsoons over a large part of India during the last two years prices of food grains have risen rendering the export of wheat unprofitable at the present time in spite of the favourable exchange.

Research.

Cotton.

7. *American.*—The department has been paying special attention to the Punjab F4 variety for the last four years because being an early maturing cotton, it can be successfully grown under the existing irregular irrigation conditions obtaining on the Jamrao Canal area. This asset was particularly noticeable in the year under report and was fully and promptly recognized by zamindars. As has been noticed elsewhere the River suddenly fell in the month of August and irrigation after the close of that month was very restricted on the Jamrao area. Nevertheless F 4 American yielded a fair return and in some cases did very well as yields of 1,000 lbs. of seed-cotton per acre are reported to have been not uncommon.

Deshi, on the other hand, in the absence of adequate September-October irrigation yielded very little in many villages especially where sowings had been late. Thus, special crop tests conducted in three Jamrao villages upon Deshi cotton revealed the following yields:—

Village No. or name.	Name of Taluka.	Area of test in acres.	Average yield of seed-cotton per acre in lbs.	Remarks.
290 ...	Jamesabad ...	8	266	Third picking much less than previous pickings.
291 ...	Do ...	4	127½	Do.
Potayun ...	Mirpurkhas ...	2	330	All pickings nearly equal.

In sharp contrast with these figures a selected strain...(P/16-22 YN) from Deshi, drilled on the Mirpurkhas Seed Farm on an area of 1½ acres, on the 21st June, yielded 1,636 lbs. (over 20 maunds) of seed-cotton per acre. This crop was irrigated 4 times as noted in the margin and the result indicates the value of a late September irrigation. Another plot X-11 drilled on the 30th June with another selected strain (P/16-30 W N) and partly resown on the 20th July was irrigated four times, the last irrigation being December 2nd, and yielded at the rate of 1,825 lbs. of seed-cotton (23 maunds) per acre which still further emphasizes the importance of Autumn irrigation for late sown Deshi cotton.

Plot.	Irrigations. No.	Irrigations. date.
1×6	1	18-8-1920.
	2	2-9-1920.
	3	17-9-1920.
	4	24-9-1920.

Similarly F4 American drilled on the 10th June and resown on the 18th July in plot XI-6 yielded 1,511 lbs. of seed-cotton per acre; this crop received four irrigations, the last on the 20th September.

It is important to note that the yields reported above are not comparable among themselves owing to variations of soil and the necessity of resowing. However half of plot VIII-6 was drilled on the 18th June with Deshi (Bhitshah) and half with F4 American. Resowing was necessary on the 9th July. This plot received three irrigations but the last one was on 21st October. The yields of seed-cotton per acre were as follows:—

Deshi	...1,124 lbs.
F4 American	...1,176 „

From a comparative point of view these results require confirmation. It seems however a fair deduction from this year's experience on the Mirpurkhas Seed Farm that F4 American drilled in May-June and irrigated four times with the last irrigation in the latter half of September, may be expected to give an outturn of 14 Bengal Maunds of seed-cotton if the standard of cultivation is good.

The agricultural advantages claimed for F4 over Deshi are summarized as follows:—

(1) Matures earlier thus releasing Autumn irrigation for Rabi crops.

(2) More resistant to both drought and water-logging.

(3) Does well on light soils where Deshi would do badly.

(4) Is less susceptible to red-leaf-blight than other American strains which moreover are slow in maturing.

8. In the year under report the department distributed 72,637 lbs. of F4 American seed mostly on the Jamrao Canal area but the acreage sown only reached 1,621 acres. Messrs. Ralli Brothers purchased practically all the crop 350 bales, apart from the 200 (?) bales grown on the Hon'ble Mr. Bhurgri's estate. A few zamindars did not sell in the hope of a rising market and of course much seed was not sown from one cause or another. The representatives of Messrs. Ralli Brothers are very interested in the development of this cotton and have a saw-gin factory at Nawabshah and also a saw-gin at Mirpurkhas. This Firm has considerable experience of this cotton grown in the Punjab and have recently established a saw-gin factory at Khanewal to deal with the Punjab crop which is now said to reach some 2 lakhs of bales. There is a ready market in India for as much of this cotton as Messrs. Ralli Brothers can supply and large consignments have found their way to Central Province Mills due no doubt to the difficulty now experienced in securing Broach of good quality. Liverpool only took some 30,000 bales of this cotton in the year under report.

The great problem of a *Buying Agency* which has caused so much trouble in previous years is thus more or less satisfactorily solved although it would be beneficial if there was some competition.

There is much difference of opinion between zamindars and Messrs. Ralli Brothers about the premium paid for this Punjab F4 cotton. The Agent of that Firm at Mirpurkhas States that the premium amounts to 50 per cent. when allowance is made for—

(*a*) the lower ginning percentage.

(*b*) the amount of admixture or foreign matter.

One maund of seed-cotton yields one seer of clean cotton less in the case of F4 American than in the case of Deshi. This works out to about 8 per cent. less lint.

In practice the zamindars obtained a premium of Rs. 2½ to Rs. 3 per maund of seed-cotton. In these circumstances some zamindars would like to have their seed-cotton ginned at the departmental Ginning Factory so that they could find a wider market for their produce.

9. Messrs. Ralli Brothers state that the staple of Sind F4 American is fully equal to Punjab F4 American but that the staple in both Provinces in the past year was affected by the shortage of irrigation when the fibre was forming; while in point of class the Sind sample surpasses the Punjab sample owing to the absence of rain in Sind. In point of feel the Sind sample is rougher than that of the Punjab sample.

10. The present situation with regard to the immediate prospects of F4 American cotton in Sind may perhaps be best gauged by the demand for seed in the current season 1921-22. The Department imported 1,500 Bengal Maunds in addition to the purchase of over 600 maunds from the factory of Messrs. Ralli Brothers and the Seed Farm crop of 220 maunds making some 1,90,112 lbs. of seed. In spite of a very unpromising inundation, preventing any chance of sowing at the popular time April-May, the whole of this seed has been taken up and the demand remained unsatisfied. This quantity is sufficient to sow over 7,000 acres but it is feared the late season will not allow that area to materialize.

11. *Sindhi Cotton.*—The Department has now several excellent strains of Deshi cotton and seed has been issued of a few of these notably 27 W. N. of which 9,400 lbs. of seed has been supplied to a seed grower for multiplication in the coming year 1921-22. In Deshi cotton ginning outturn, class and bulkiness are the three characters which the Trade look to because staple in this cotton is of no account. Several of these strains have been submitted to the Trade who after ascertaining the ginning outturns have expressed much satisfaction. In addition the best of these strains are very prolific in the field, for example, P/16-30 W. N. yielded slightly less than 23 Bengal maunds of seed-cotton per acre, *vide* para. 7 *ante* and P 16-37 Y. N. yielded up to 21 maunds per acre in the year under report on the Seed Farm at Mirpurkhas.

12. *Botanical Work.*—This is being continued on the same lines as in previous years on both American and Deshi cottons.

Rice.

13. This crop is dealt with on the Larkana Farm. The irrigation difficulties frequently referred to in the past reports, were again pronounced in the year under report.

The first inundation water of the season reached the Farm on the 11th June. The Abro Canal however was closed again on the 14th June.

This canal was soon reopened but was closed again on the 27th June for one day; subsequently this canal was closed at intervals.

The supply of flow water to the Farm rice land ceased permanently on the 20th August but part of the crop was subsequently once watered by pumped water from the 9th to 15th September.

Transplantation commenced three weeks later than in the previous year, on the 5th July and was completed on the 28th July.

The irrigation period for the standing rice crop thus lasted for 23 days in the case of the last transplanted plot and for 46 days in the case of the first transplanted plot whereas 75 days may reasonably be claimed, for a full crop in this tract.

14. In such adverse circumstances experimental work is not a practical proposition and the results from the following experiments may be regarded as unreliable :—

(*i*) Irrigation intervals—1, 2, 3 and 5 days.

(*ii*) Seed Rate trials—12, 24, 36, 48 and 96 lbs. per acre.

(*iii*) Dates of Transplantation—5th, 15th and 25th July and 5th August.

(*vi*) Rab investigations.

It will be useful however to record certain observations.

Irrigation Intervals.—Notwithstanding the short total period of irrigation Sugdasi, a late variety, yielded at the rate of 1,788 lbs. of grain per acre on half an acre in plot A 3 (first half). This plot was transplanted on 5th July and was assisted in September with one lift-irrigation. Similarly Kangani, a medium early variety, transplanted on the 5th July yielded at the rate of 1,884 lbs. of grain per acre on half an acre in plot B3 (first half). This plot was also assisted in September with one lift-irrigation.

These two crops were more or less regularly watered for the first 46 days, subsequently after an interval of three weeks they received one irrigation.

Sathri, an early variety, transplanted on the 22nd July and assisted with one lift irrigation in September yielded at the rate of 2,000 lbs. of grain per acre on a sub-plot of A6, not irrigated after the 20th August. A "Kharar" of paddy (1,620 lbs.) per acre is considered a very good crop and the average yield in Larkana district is perhaps 1,400 lbs. per acre.

Seed Rate Trials.—The 12 lb. seed rate was found to produce enough seedlings for 11½ gunthas only when the bunches consisted of 3 seedlings and the distance between bunches was 8 inches. The 48 lb. seed rate produced enough seedlings to transplant a full acre with bunches containing 5¼ seedlings spaced 7½ inches apart.

On the other hand a 48 lbs. seed rate gave a superior crop measured by outturn, to a 96 lb. seed rate (the local one); with the former seed rate the interval between bunches was 6 inches and with the latter, 4 inches, thus:—

Name of variety.	Seed rate per acre in lbs.	Yield per acre in lbs.	
		Grain.	Straw.
Sugdasi ...	48	1,364	2,080
Do. ...	96	1,136	2,980
Kangani ...	48	1,208	1,020
Do. ...	96	640	600

Dates of Transplantation.—The following yields obtained from plots A3 and B3 which received irrigation for 46 days and subsequently after an interval of three weeks were irrigated once, are interesting as bringing out the marked effect upon the yield of rice by a delay of even 10 days in the date of transplantation :—

Name of variety.	Date of transplantation.	Yield per acre in lbs.	
		Grain.	Straw.
Sugdasi ...	5th July	1,788	3,000
Do. ...	15th „	1,372	2,392
Kangani ...	5th „	1,884	1,632
Do. ...	15th „	1,580	1,400

Rab Investigations.—Several treatments were under observations and results have to be judged by several criterions.

Seed-bed Period.—Stimulating manures like sulphate of ammonia and unburnt cattle dung delay the readiness of seedlings for transplantation. Taking 3 weeks for the period of an ash plot the ammonium sulphate plot required over a month and the unburnt cowdung plot about 6 weeks.

Facility for Uprooting—Wet-plucking—Seedlings from burnt cowdung plots came out clean while those from the ammonium sulphate plot had much soil adhering. Dry plucking—In the case of burnt manure plots the seedlings came out clean while in most other treatments the rootlets appeared damaged.

Behaviour of subsequent Crop.—The yields of paddy per acre obtained from seedlings raised by sulphate of ammonia and by unburnt cowdung held their own with that obtained from the burnt cowdung seed-bed seedlings.

Wheat.

15. Considerable progress has been made with the establishment of a large Farm at Jacobabad specially opened in the wheat interest. In the year under report the area sown with wheat was 54 acres but it is hoped in future to maintain a wheat area of 100 acres, all intended for seed production. Most of the area sown in the year under report was seeded with Pusa 12 obtained from the Punjab while the balance was sown with Punjab 11 and Phandani wheats. This wheat was drilled on the 12th to 17th November and matured without subsequent irrigation by the "Bosi" system of cultivation. This date proved too early for such a rapid maturing wheat as Pusa 12 which was in earhead in early February when frost caused damage. Apparently it will be necessary to delay the sowing of this wheat till the end of November as it comes into earhead in little over 80 days.

In the coming season the Farm will be stocked with 50 maunds of this variety kindly supplied by Mr. Howard from his botanical area at Pusa.

This wheat has met with much approval in those parts of Sind which are not too much wooded—such as the large unbroken expanses of wheat land in Upper Sind Frontier Province and the enormous "Katcha" areas along the Indus River which are annually submerged.

On the Jamrao Canal area, there are too many trees, harbouring birds, for an awnless wheat to have a chance.

In spite of damage from frost last year rendered possible by too early sowing, K. S. Sardar Chakarkhan grew 250 to 300 acres of excellent Pusa 12 in the year under report in his village in Kandhkot taluka, Upper Sind Frontier district.

Again in the year under report Mahomed Taib of Sekhat village of Hyderabad district took 40 Bengal maunds of Pusa 12 and sowed it on some land reclaimed from a forest area and in spite of the rough condition of the land a yield of 10 Bengal maunds per acre was obtained.

Syed Allandadshah of Unerpur of Manjhand Mahal took 9½ maunds of seed and the yield obtained was at the rate of 18 maunds per acre in spite of much damage from birds and pigs. Other growers are reported to have secured an outturn of 15 maunds per acre.

These are good results in a bad wheat year.

16. As regards Punjab 11—500 maunds (Bengal) were supplied to Syed Ali Muradshah, Sita Village, Larkana district but the results are not yet forthcoming.

A large quantity of this seed distributed on the Jamrao area could not be sown for want of irrigation.

17. *Botanical Work.*—This work upon the isolation of pure cultures from the wheats indigenous to Sind was duplicated at Mirpurkhas and Sukkur, by way of precaution. Striking results were obtained at Sukkur and some very promising strains have been evolved.

Fodders.

18. At Sukkur a comparative trial was made with American Dwarf Jowar (Black Hall Kaffer), Sundhia (from Gujarat) and the local Red Sathri variety, all sown on the 16th June. In point of yield these varieties stood as follows:—

American Dwarf	... 80.
Sundhia	... 90.
Red Sathri	... 100.

The palatability of these fodders was tested by placing some chaffed fodder of each variety in three adjacent baskets and allowing half a dozen buffaloes access in turn. Each animal without exception sought out the American Dwarf variety first, then the Sundhia and finally the Red Sathri and this is obviously the order of sweetness.

On the 16th September when all varieties were in flower observations revealed the following facts:—

Name of variety.	Average height in feet.	Nature of stalk.	Description of leaf.	Susceptibility to disease.	Remarks.
American Dwarf ...	5½	Very thick	Broad and hard; like sugarcane in middle and pointed at end.	Very susceptible to borer.	Flowers 3 weeks later than Red Sathri; tillers prolifically.
Sundhia ...	8¼	Thin	Soft; turning white on maturity.	Not much susceptible to borer.	
Red Sathri ...	8	Thicker than Sundhia.	Turning red on maturity.	Do.	

Fruit.

19. This work was continued at Mirpurkhas on the same lines as hitherto. The Citrus family appears to be the most important fruit for the Jamrao tract from a business point of view. In these circumstances an area has been allotted for a comprehensive collection of the various varieties of orange, lemon and other members of the Citrus family. Plants have been obtained from various parts of India and established. A collection of the possible stocks for oranges has also been made and the best one for propagation in Sind will be determined. In spite of the failure of irrigation sales of Citrus fruits exceeded Rs. 900 in the year under report.

20. Since the termination of the war efforts have been made to obtain representative varieties of Dates from the best known Date Countries. Consignments have recently been received from Egypt and Mesopotamia and planted at Mirpurkhas. The Date is a fruit deserving of the fullest exploitation in Sind where the conditions suit its cultivation. Some imported varieties established at Landhi have come into bearing in the year under report.

21. The grape is also a fruit which does very well in Sind. The fruit produced on the Mirpurkhas Farm has acquired a good local reputation and commanded prices ranging from 8 annas to one rupee per seer in the year under report. The local Gulabi variety is in chief favour but other varieties are being tested.

22. Among bush-fruits the Phalsa is doing well at Landhi where the plants on half an acre of land are bearing very prolifically at the present time. On this Farm the Papaya is a very valuable crop.

IMPLEMENTS AND MACHINERY.

23. *Ginning Factory.*—This is a small Factory containing 10 Single Roller Gins, an opener and a 40 B. H. P. Semi-diesel complete combustion Crude Oil Engine.

Such a ginnery can gin 150 maunds of seed-cotton when running in the day time only. The year under report covered the second season in which the Department has possessed this Factory and the quality of the ginning was greatly improved as compared with that of the previous year. This Factory is the potential means of securing a pure cotton-seed supply for Sind. Experience over many years has shown that seed ginned in a public factory in Mirpurkhas cannot reasonably be expected to be pure owing to the limited storage accommodation and the unlimited opportunity for admxiture at various

stages, *e.g.*, (*a*) while the seed cotton is heaped in the compound, (*b*) is in transit to the gins, (*c*) is passing through the opener and the gins, (*d*) in the corridors where the seed is collected after ginning and finally (*e*) in the seed dump in the compound. In the case of a public factory it is almost impossible to remove every seed that gets held up in the machinery, in the wood work and in the corridors, before commencing the ginning of some new variety of cotton. Yet it is essential if American cotton is to fetch its proper price, that the seed supplied to the grower and the produce delivered to the Trade shall be free from any admixture of the Deshi article. The exact amount of ginning which the Department will undertake is still a matter for decision but in the past year the work done in the Factory was restricted to the produce of the Seed and Experimental Farms at Mirpurkhas and 210 maunds of seed cotton purchased from a seed-grower, amounting in all to 73 bales.

24. *Power-threshing.*—This was carried on at Jacobabad Wheat Farm.

Power Chaff-cutting.—This was carried on at Mirpurkhas Seed Farm.

Pumping.—The department has one or more pumping plants at four of the Farms.

25. *Tillage Implements.*—Two new types of Clod-Crusher as tabulated below have been secured from England. These are very effective implements in Sind and the points under investigation are :—

(*a*) how to reduce the draught without losing efficiency and (*b*) the most effective type of "ring" both as regards diameter and design. A small diameter—16 inches—secures greater periphery speed but involves heavier draught. The notched design of "ring" is found more effective than the fluted "ring".

Manufacturer.	Type.	Width in feet.	Diameter of "rings" in inches.	Remarks.
W. N. Nicholson & Sons, Ltd., Newark-on-Trent.	Notched Self-cleaning Cambridge Roller.	5	24	1. Iron frame. 2. Notched and ribbed rings arranged alternately on the axle. 3. The notched rings, having central holes larger in diameter than the axle, rise and fall with the irregularities of the ground surface and break up any accumulation of clay from the ribbed rings. 4. The draught pole is of tubular iron. 5. The draught brackets have renewable bushes and large grease boxes with lids.
J & F. Howard, Bedford ...	Crosskill Roller (Light pattern).	4	16	1. Wrought angle iron frame with hard wood, lignum vitae, bearings. 2. 16 Clod-Crusher or notched rings, 8 spare fluted rings for adjusting alternately with notched rings if desired. 3. Wrought iron brackets.

Horse Hoes.—Three of these implements have been secured but have not been thoroughly tested yet. Inter-cultivation in line-sown cotton is most essential in Sind where the soil, owing to its fine texture, sets very tight after irrigation and weeds grow very rapidly. Past experience has shown that any broad faced implements cannot be worked successfully in such soils owing to the excessive resistance of the soil, hence it is essential that the tines should be as narrow as possible. The hoes obtained have this character and also strong angle iron frames. The locally made hoes with wooden frames, recommended by the Bombay Department of Agriculture, are hardly strong enough for Sind conditions—

Manufacturer.	Weight in lbs.	Type.	Description.
Thomas Hunter & Sons, Maybole.	76	Expanding iron drill harrow.	The manufacturers state that this harrow has replaced the ordinary wooden drill harrow. The tines are firmly fixed with screwnuts and are in no way liable to shake out

Manufacturer.	Weight in lbs.	Type.	Description.
S. L. Allen & Coy, Philadelphia, U. S. A.	53	Planet Junior Twelve-Tooth harrow with No. 4 Expander.	This implement carries the register number 92 among Planet Junior Implements. It is fitted with a steel wheel.
Wm. Cottis & Sons, Ltd., Epping, Essex.		Patent expanding horse hoe with hind wheel (pattern strong, with 5 tines to open 2 feet plus small rear harow).	1. The tines are easily altered to any width and are shaped to bring the weeds to the surface and are self-clearing. 2. Accessories— (*a*) One dozen spuds H. 1. (*b*) One dozen spuds H. 82. (*c*) One hoe H 6. (*d*) Half dozen side hoes H. 15 Left. (*e*) Do. H. 16 Right. (*f*) Two sets of steel hoes.

Planet Junior Hoes.—The small manual types of these useful implements have been found very effective in the light soil of Landhi but are less suitable for the fine textured soils prevailing over the greater part of Sind as the resistance of the soil renders the draught excessive. The following designs have been found very useful:—

Register No.	Design.	Equipment.
17	Planet Junior Single wheel hoe.	1. Steel frame, wooden handles. (All oil tempered.) 2. One pair of 6 inch hoes. (All oil tempered.) 3. Three steel cultivator teeth. (All oil tempered.) 4. One large garden plough. (All oil tempered.) 5. One spanner.
38	Planet Junior Single wheel disc hoe, cultivator and plough.	1. Steel frame and wheel: wooden handles. Oil tempered. 2. One set of disc hoes in threes. Oil tempered. 3. One plough. 4. One pair 3 prong cultivator teeth. 5. One leaf lifter. 6. One spanner.
	Planet Junior star Pulverizer, Leveller and wheeler.	1. Frame and handle. 2. One set of two pulverizing axles. 3. One rear blade 13½ inches.

Hand Drills.—Two of these such as are suitable for use in allotments—manufactured by Messrs. Kell and Coy., Gloucester—have been obtained with a view to their use in sowing small quantities of pedigree seed an operation which often presents a difficulty, when hand sown owing to loss of moisture when the soil is opened by a hand-tool for an appreciable time, and also to the liability of seed not being deposited at the optimum depth.

Live Stock.

26. The Willingdon Milch-Herd of Red Karachi-cattle which the Agricultural Department is taking charge of pending the opening of the Farm near Karachi which is to be the permanent home of this herd, has now reached 37 head as indicated in the following tabular statement:—

Date.	Bulls.	Cows.	Heifers	Bull calves.	Total.
Balance 1-4-1920 ...	5	9	8	11	33
Calved in 1920-21 ...			4	3	7
Died in 1920-21 ...		1	1	1	3
Transferred ...	1 (+)	1 (+)	1 (−)	1 (−)	
Balance on 31-3-1921 ...	6	9	10	12	37

The preponderance of bulls is intentional in order to provide for the simultaneous breeding of pedigree stock without blood relationship.

27. The maintenance of these cattle in the year under report when the Jamrao Canal failed causing widespread acute fodder shortage, caused much anxiety as it was not possible to grow berseem at Mirpurkhas during the Rabi season, which is the mainstay of the winter fodder supply. This failure upset the fodder organization and the Department decided to move as many as possible of these stock to Landhi where some land commanded by well irrigation was taken on rent. This land was sown with berseem but it was late in December before it became ready for a first cutting and hence the cattle could not be transported till the 19th December. Meanwhile these cattle lost condition but all have recovered since except a few of the young stock.

28. The cows in milk were retained at the Mirpurkhas Experimental Farm where the supervision is adequate but in the absence of green food the milk yields have ruled low. The highest monthly outturn of milk per animal was 400 lbs. of milk in the month of February 1921 by cow No. 2 and the highest yield for a lactation of 10 months was 2,457 lbs. by cow No. 3 which, however, continued in milk for sometime longer and her yield for the full lactation reached 3,256 lbs. of milk. These yields would probably rise 50 per cent. under conditions where there is an ample supply of green fodder.

29. The Civil Veterinary Department has quite recently announced that it is ready to take over these cattle and the transfer will be effected very soon.

30. The Department continued to maintain a Milch-herd of Delhi buffaloes at Sukkur. As a buffalo consumes a very large quantity of food care is taken to retain only first class milkers and the average milk outturn of this herd which exceeds 3,500 lbs. of milk per head is satisfactory. An outturn of 6,000 lbs. is reached by the best animals, and such are very valuable for breeding purposes.

Miscellaneous.

31. The chief publication of Agricultural interest during the year has been Mr. Tamhane's Bulletin on Soil and "Kalar". Two interesting points brought to light are :—

(1) The adverse effect of "Kalar" upon the soil in Sind is not toxic but physical, destroying the texture of the soil. Where the texture is preserved by natural drainage, *e.g.*, the proximity of a sand layer, the crop will be stimulated by the presence of 3 per cent. of soluble salts. Where the soil becomes impervious owing to a deep layer of subsoil clay the presence of 3·6 per cent. of the same salts will render crop growth impossible.

(2) A low percentage of potash seems to be characteristic of the sandy silt borne by the Indus whereas the finer grained soil appears to be quite rich in potash.

Propaganda.

Seed and Implement Supply.

Jamrao Area	...	63,414
Nawabshah District.		8,723
Sukkur	„ ...	260
Larkana	„ ...	120
Hyderabad	„ ...	120

32. *Cotton.*—The American Cotton seed distributed to the public in the year under report was 72,637 lbs. of F4 as shown in the margin.

The quantity of 27 W. N. (a selected strain in Deshi) distributed was 2,400 lbs.

District.	Pusa 12.	Punjab 11.
Jamrao area ...	12,400	109,170
Hyderabad ...	7,500	...
Nawabshah ...	4,880	8,000
Larkana ...	...	46,240
Karachi ...	...	160
Sukkur ...	12,520	...
	37,300	163,570

Wheat.—The total quantity of wheat seed distributed in the year under report was Punjab-11, 163,570 lbs.; Pusa-12, 37,300 lbs. allotted as noted in the margin.

Berseem.—Only 2,495 lbs. of seed of this fodder crop were distributed in the year under report as irrigation facilities were very restricted.

Fruit Stock.—The chief item was some 800 Citrus plants (oranges and lemons) from Mirpurkhas.

Ploughs.—The distribution of iron ploughs is suspended owing to the current prices being prohibitive. Egyptian wooden ploughs are now manufactured in Sind; hence the Department is relieved of the task of supplying them and only distributed two dozen in the year under report.

Agricultural Shows.

33. The Agricultural shows intended to be held at the marginally noted centres were abandoned in deference to the bad season but the Collector of Nawabshah arranged with the Department to hold a Demonstration at Nawabshah which took place in February and the Department were also represented at the Ghotki Fair in Sukkur district where some 40,000 persons assemble. Other demonstrations arranged to be held at Shahdadpur, Kandiaro and Sinjhoro in Nawabshah district were abandoned on account of Rinderpest.

1. Nawabshah.
2. Landhi.
3. Larkana.

Demonstrations.

34. These demonstrations range from organized assemblies of zamindars down to the working-exhibition of implements in the fields of cultivators.

In the year under report the Department organized two Zamindari " Visits. "

The first took place on the Mirpurkhas Seed Farm in the month of December with the special object of bringing to the notice of the public the excellent results which had been obtained with F4 American Cotton which had yielded at the rate of 14 Bengal maunds of seed cotton over a large area. The visitors were very favourably impressed.

The second " Visit " took place at the end of February in village 279 of Taluka Jamesabad on the lands of Nurshah, son of Syed Shershah, a past student of the Agricultural School at Mirpurkhas who had been taught the possibilities of growing wheat with a minimum application of water subsequent to sowing. As the Jamrao Canal failed in the Rabi season this young man turned his knowledge to practical account by sowing 42 acres of wheat according to the system recommended by the Department. The standing crop received no irrigation. The crop was a fairly good one and created a marked impression upon the 100 odd visitors who could not fall back on the usual argument that Government being rich, could afford to spend much on tillage, for the simple reason that the crop was a zamindari one. Unfortunately as this was the only wheat in the country-side it fell a special prey to birds.

36. The Department is carrying on a campaign to induce zamindars to abandon the broadcast method of sowing cotton in favour of the " line " method. The great advantage of the latter method is that it enables the work of hoeing and most of the work of weeding to be done by bullock power instead of by manual labour, thus solving the labour problem at a time when it is apt to become acute, and saving both money and time. To popularize this system of sowing cotton demonstrations were arranged in the marginally noted villages.

Name of village.	No. of acres operated on.	Name of Taluka.
290 A	33	Jamesabad
257	44	Do.
Doulatpur	20	Mirpurkhas
Shadipalli	13	Jamrao
Hyderabad	1½	Hyderabad
Uderolal	4½	Hala
Nawabshah	6	Nawabshah

Varying degrees of success were obtained according to the Departmental organization, the quality of the demonstrators and the seasonal difficulties which arose. As this method of sowing has inherent merit, it is sure to extend where the zamindars are progressive and willing to level their fields. The Honourable Mr. Bhurgari the foremost large zamindar on the Jamrao area wrote as follows :—

" During Kharif 1920-21 about 40 acres of my land in Deh 290-A Jamesabad were drilled by the trained hands of the Agricultural Department, the drilling has been so very nicely done that the plot viewed from the road gives the pleasant appearance of a garden. The hoeing done by working ploughs through the rows have also been done very carefully, so that, we have to spend nothing on hand-hoeing, and these operations have done much to keep down rank growth of weeds, as is the case in an ordinary plot of more or less equal size which was sown by ordinary broad-cast method. Notwithstanding the fact that the cultivator spent a sum of Rs. 42-0-0 on hand-hoeing on only 7 acres the weeds have to a great extent affected the growth of this broad casted area besides broad casted area received one more watering than the drilled plot.

I am very much pleased with this system of sowing cotton and Agricultural Department may congratulate itself upon the introduction of this method. I have resolved to extend this practice gradually on my estate and wish to get one complete Deh drilled next year. "

Agricultural Education.

37. The organization for this work remains unsatisfactory. During the past two years the matter has received critical attention. Three essential points emerged as the result of various discussions between Agricultural and Revenue Officers and zamindars :—

(1) An Agricultural School to be successful in Sind must draw its pupils from among the well-to-do zamindari class or at least the khatedar class.

(2) Estate management, as distinct from the technical processes of agriculture should be the primary objective of the School for the former class, although the latter should be regarded as very important.

(3) Facilities for learning English must be provided in the former case.

Proposals based on these considerations have been before Government for a very long time.

38. The present Agricultural School at Mirpurkhas provides none of these conditions. The great majority of boys are drawn to the school by the scholarship and by the chances of service. The land availabe for instruction is borrowed from the Experimental Farm and the teaching of English would be out of place among the present class of pupil.

It is strongly urged that the School should not continue to be run on lines recognized for years past to be unsuitable for the Province. It seems highly desirable to close the School pending the establishment of a suitably organized institution.

39. In the year under report the eighth session came to a close in July 1920 when five out of six boys passed the leaving examination. Eight other boys who had entered the School left without completing the *course*.

The ninth session opened in September 1920 and the number of boys reached 12 in December but has since fallen to 7.

40. There has been a good deal of difficulty in staffing the School with a head-master in the year under report. Mr. Alimahomed the permanent incumbent took privilege leave for nearly three months (November 1919 to January 1920).

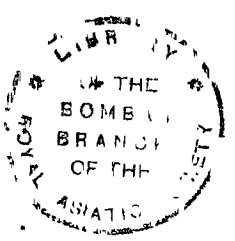
In October 1920 again, Mr. Alimahomed was relieved of the School duties on grounds of ill health and there have been two head-masters in charge since then. Apart from these constant changes in personnel there has been practically no irrigation available at Mirpurkhas during the whole of the current session, up to the month of May. In these circumstances the School was transferred to Sukkur for nearly two months, February and March, and also was conducted on a tour of the Province. On these grounds also it seems impracticable to continue to run the School at its present location. The cost of the School under all heads amounted to Rs. 3,550-0-0 as against Rs. 3,939-11-10 in the year 1919-20.

Karachi:

7th June 1921.

T. F. MAIN,

Deputy Director of Agriculture, Sind.



APPENDIX G.

Work done under the Professor of Agriculture, during the year 1920-21.

Staff.

Besides the duties of teaching and superintending the Agricultural teaching of the College, the Professor of Agriculture has three stations under his charge, *viz.*, Agricultural area connected with the Agricultural Branch of the College, College Dairy, and the Manjri Sugarcane Experiment Station, consisting of 185, 338, and 93½ acres respectively.

The Agricultural and Dairy staff manage the first two stations and a special staff is entertained for the sugarcane station.

Formerly some district work was also entrusted to the Professor of Agriculture which kept him thoroughly in touch with the departmental work. If the sugarcane propaganda of the Deccan was under the Professor of Agriculture the work of Manjri Farm would be much more valuable. During the year the Principal's duties have also been performed by the Professor of Agriculture.

Agricultural Branch Area.

This area is mainly utilised for demonstration and for practice by the students. No regular experiments are possible although in next year's programme small plots have been allotted to all students electing Optional A. in order that they may get some experience in experimental work. All crops that can be grown in Poona are tried on the area attached to this branch of the College. Both the best local and improved methods are used in their cultivation. Especial attention is paid to the more economical use of water (both rainfall and irrigation), manure and labour. Wastefulness of these things in Farm practice is at present one of the greatest faults in Indian Agriculture. Particular emphasis is laid on the making all methods adaptable to ordinary farmers' conditions.

The statement below shows the result of the year on the students' plots as to yields:—

STATEMENT.

No.	Name.	Area.		Outturn per acre.			Remarks.
				Nature.	Principal in lbs.	Secondary in lbs.	
		A.	g.				
1	Turmeric Mixture—	1	10				
	Consisting of Turmeric ...			Rizomes ...	8,992		
	Yams ...			Tubers ...	1,152		
	Gavar ...			Pods ...	672		
	Bhendi ...			Vegetable ...	212		
	Suran ...	0	20	Rizomes ...	23,126		
	French Beans ...	1	0	Green Pods.	5,721	5,693 Fodder.	
	Tomatoes ...	1	10	Fruits ...	17,888		
	Potatoes ...	2	20	Tubers ...	2,371		
2	Bhindi Mixture—	1	10	Vegetable ...			
	Consisting of Bhindi ...			,, ...	2,468		
	Radish ...			,, ...	4,404		
	Coriander ...			,, ...	1,964		
	Maize ...			,, ...	456	360 Fodder.	
	Dudhia ...			,, ...	100		
3	Khira (Cucumber) ...			Vegetable ...	5,284		
4	Brinjal ...	1	0	Fruits ...	6,849		
5	Panmala ...	0	12	Leaves ...	933,616		
6	Ginger ...	0	20	Rizomes ...	3,000		

No.	Name.	Area.		Outturn per acre.			Remarks.
				Nature.	Principal in lbs.	Secondary in lbs.	
		A.	g.				
7	Leafy Vegetable—						
	Consisting of Methi ...	0	30	Vegetable ...	3,542		
	Coriander ...			„ ...	2,072		
	Shepu ...			„ ...	976		
	Radish ...			„ ...	4,884		
	Chakwat ...			„ ...	536		
	Chuka ...			„ ...	1,780		
8	Onion ...	0	10	Seeds ...	368	3,064	
9	Wheat (dry) ...	2	20	Grains ...	540	1,103 Bhusa.	
10	Bajri ...	7	10	Grain ...	954	1,826 Sarmad. 372 Bhusa.	
	G. Nuts (dry)—						
	Spanish Pea Nuts.	0	20	Pods (dry).	1,158	2,300 „	
	Big Japan ...		10	„ ...	2,524	2,000 „	
	Verginia ..	0	10	„ ...	1,600	2,600 „	
	Mauritius ...	0	10	Pods ...	1,300	2,800 „	
	Pondicherry ...	0	10	„ ...	1,340	2,680 „	
11	Gram, yellow ...	0	20	Gram ...	600		
	Shalu Jowar—						
	Dagdi ...	0	20	Grain ...	900	9,548 Fodder.	
	Maldandi ...	0	20	„ ...	840	9,696 „	
	Kharif Jowars—						
	Nilva ...	0	10	Grain ...	560	2,240 Fodder.	
	Perio ...	0	10	„ ...	1,060	5,320 „	
	Gotya ...	0	20	„ ...	772	4,805 „	
	Garya ...	0	10	„ ...	976	5,400 „	
	Sholapuri ...	0	30	„ ...	714	3,242 „	
	Fulgar, yellow ...	0	20	„ ...	526	1,720 „	
	Chapti ...	0	20	„ ...	718	1,794 „	
	Gudaghi ...	0	10	„ ...	734	1,632 „	
	Ellichpuri ..	0	10	„ ...	568	1,920 „	
	Fulgar, white ...	0	20	„ ...	432	1,960 „	
	Nandial ...	0	20	„ ...	212	1,330 „	
	Cotton—						
	Khandesh Mixture ...	0	10	Seed Cot. ...	344		
	N. V. M. ...	1	10	„ ...	1,133		
	N. V. ...	0	10	„ ...	964		
	N. R. ...	1	10	„ ...	921		
	N. R. C. ...	0	10	„ ...	460		
	Mathio ...	0	10	„ ...	940		
	Khandesh Mixture ...	0	10	„ ...	828		
	Bani ...	0	10	„ ...	560		
	Cambodia ...	0	10	„ ...	652		
	Georgian ...	0	10	„ ...	388		
	Kumtha ...	0	20	„ ...	622		
	Waghad ...	0	10	„ ...	164		
	Ghogari ...	0	20	„ ...	662		
	Surat Selection ...	0	10	„ ...	84		
	Navsari ...	0	10	„ ...	110		
	Broach ...	0	10	„ ...	436		

The year was very unfavourable for dry cultivation, although the total effective rainfall was twenty inches. The early sowing rain was less than three inches, so that imperfect germination resulted. July and August together gave only seven inches with very long breaks. Most of the effective rain came in September and October too late to be of the greatest good. Even in the face of these adverse conditions the yields of the grain crops and cotton are considerably higher than those of the country side. They are as follows:—Bajri grain 954 lbs., Jowar grain 671 lbs., Rabi Jowar grain 870 lbs. and cotton 898 lbs. (kapas).

While the College area is not an Experimental Farm I believe that the results obtained from our dry area in a period extending over a dozen years are so much above the average of the country side that the methods which we have employed are well worth introducing widely. Since giving up district work in 1911 I have had few opportunities of demonstrating these methods to the public and I wish I had at least one district in my charge where they could be shown. In the table below I give the outturn at the College for 12 years, and for comparison what is estimated to be average crops on cultivators' farms. It will be seen that in years of scanty rainfall our average increase is 335 per cent. In moderate rainfall 94·7 per cent. and in good years only 49 per cent. Such increase which is entirely due to water saving is worthy of further consideration. Our area is in no way superior to the average of Poona district. We give no manure except a slight dressing of farm yard manure to the cotton area of 10 loads every other year. Bajri gets no manure at all and the very fact that our gain is greatest in years of light rainfall shows that our success is only due to moisture conservation. This is not the time or place to give a detailed account of our methods; hence I will only say that they are simple and inexpensive and quite within the reach of the poorest cultivator—

STATEMENT.

Name of Crop.	Rainfall Below 18". Years of short rainfalls (09-10, 11-12, 18-19).			18" to 28". Years of medium rainfall (08-09, 12-13, 13-14, 16-17, 20-21).			Over 28". Years of bumper rainfall (10-11, 14-15, 15-16, 17-18, 19-20).			Average for all years.			Remarks.
	Farm average yield.	Cultivator's yield (Deccan).	Percentage of increase.	Farm average yield.	Cultivator's yield (Deccan).	Percentage of increase.	Farm average yield.	Cultivator's yield (Deccan).	Percentage of increase.	Farm average.	Cultivator's average.	Percentage of increase.	
	lbs.	lbs.		lbs.	lbs.		lbs.	lbs.		lbs.	lbs.		
1 Cotton, Varadi ...	505	308	68	817	450	81	754	600	25	724	459	60	General increase of 15 per cent. within 5 years.
2 Cotton, Broach ...	497	250	99	647	450	45	814	800	1·7	681	450	51	
3 Bajri ...	1,057	250	321	857	450	95	719	400	79	850	450	88	
4 Kharif Jowar (Grain).	1,458	800	386	886	600	47	949	800	14	1,025	600	41	
5 Kharif Jowar (Fodder).	5,485	1,200	357	5,963	2,000	198	7,560	3,000	152	6,930	2,000	246	
6 Rabi Jowar (Grain).	1,139	150	660	1,041	600	73	1,235	800	54	1,105	600	84	
7 Rabi Jowar (Fodder).	5,016	900	457	4,478	2,000	124	5,442	2,500	118	4,611	2,000	130	
Average of increase			335			94·7			49			100	
Average Rainfall ...		14·92 inches			24·54 inches			32·07 inches			26·91 inches.		

Distribution.

Implements, seeds and manure are distributed according to demands received by the Agricultural Branch.

Several firms stock implements here for sale but the high prices prevailing since the war has greatly reduced this kind of distribution.

The workshop attached to this Branch repairs implements of the Farms and when possible of the public besides making some of our new devices. Every morning the workshop is engaged by the students.

The seed distribution business is increasing in volume. Part of the seed is from the Farm plots but a large portion is procured from growers either direct or through the District Agricultural staff. We clean, grade and test the vitality of the seed before sending out. Lucerne, onion, sann, jowar for fodder, cotton, chavli and vegetables are the largest items.

Miscellaneous Work.

From February 14th to June 1st two of the staff of the Agric. Branch were deputed to work for the Deputy Director of Agriculture for Animal Breeding on famine duty in saving cattle with prickly-pear. The experience of 1917 made them exceedingly useful for this.

Further help was given to the Agricultural Engineer in the testing of tractors and implements. Help and advice was given to sugarcane companies. There is an increasing correspondence on agricultural matters from the general public.

College Dairy.

The plans for the new dairy school were held in abeyance owing to the consideration of instituting an amalgamated school with the Military Department. In this case it was proposed to locate the school at the Military Dairy, Kirkee and utilise their plant for instructional purpose. For various reasons this plan has been abandoned and plans for our new school on the present dairy site are in hand.

The temporary dairy has been improved by enlargement of the room and the building of a washing verandah. Part of the apparatus for the new school has been obtained and is now being utilised for teaching in this building. We now have seven separators and four churns for practice work, a Gurber milk tester and an acid test. A small pasteurizer and boiler have also been installed. This makes it possible to greatly improve the former course but it is very far from satisfactory even yet.

The great problem in the cost of milk production in the vicinity of large cities is that in sufficient area of cultivated land is available to produce the necessary fodder. Green fodder approaches most nearly to the natural herbage that normally constitutes the food of cattle. When this is not available and when dried grass or fodder with concentrates like oil-cake, cotton-seed, &c., are depended upon to furnish the nutrient for milk making, both the quantity obtained and length of the milking animal's life, are shortened. At the same time the cost of milk is increased. An animal weighing eight or ten hundred pounds requires about 70 pounds of green fodder, then, she is able to consume, in addition, six to seven pounds of concentrates. With this feed the highest possible yield will be obtained. Larger amounts of concentrates will be required when dry fodders are used but in such amounts they have a tendency to injure the health.

From the first of the College Dairy there has always been a shortage of green fodder. For a time it was sought to remedy this by carting green fodder from the Manjri Kuran area, but this was found impractical. We therefore have worked out a system of intensive cultivation by which from our area of thirty five acres we are able to furnish a sufficient supply of green fodder, the year round.

There has not yet been a complete year under this system as the work was begun only upon the harvest of the first monsoon crop. Given perennial water it is easy to secure four crops of fodder maize within 12 months. Manure must of course be applied. The manure from the byres is taken direct to the field without any rotting. If manure is utilized in this way it is essential that the animals should not have been fed on grass or weeds that could supply weed seeds.

The water this year failed in the canal so that the last crop sowing was delayed by two months, thus 14 months were required for the four crops, whereas ordinarily, only 12 would have been sufficient. On an area of 21 acres which was cropped four times within 12 to 14 months the average outturn per acre per crop comes to 13,768 lbs. of green fodder or an annual outturn of nearly 25 tons per acre.

Herd.

14 cows and 29 buffaloes having become aged and unprofitable were disposed of and eight new ones purchased. On April 1st there were twenty-one cows and forty buffaloes in the milk herd. The total milk produced was 150,659 lbs. slightly less than in the previous year but by this weeding out of "free boarders" we have brought the average for the entire herd, adults and heifers, from 1,613 per annum to 2,008.

While representatives of other breeds are kept for demonstration the Karachi (Sindh cows) and Surati (Nadiad) buffaloes form the main part of the herd. The breeding of certain strains of these have been carefully gone on with for several generations. The fifteen Sindhi cows average 2,201 pounds last year. This includes a few animals which have to be cast for age or for poor yields, and two heifers with first calves. Two of our heifers gave an average of 2,727 lbs.

One of these Chrissie may be taken to show the improvement affected in the strain. Her dam Changuni and her grand mother Zankar were both superior animals with records for long periods. Their average yearly yields are 3,350 lbs. and 3,514 lbs., respectively.

If the first year's outturn only of these three which is the only records available for comparison be taken we get as follows:—

Grand dam. Zanki.	Dam. Changuni.	Cow. Chrissie.
3,117	3,741	3,919

A sister of Chrissie has calved and has given 525 lbs. per month which bids fair to eclipse all other records of our heifers. These records are without the calves which are entirely hand fed.

Among our Surati buffaloes, Sarjani stands out with an average annual yield for 14 years of 3,410 lbs. She is a regular breeder having had 12 calves in less than 14 years.

A number of buffaloes heifers have just calved and are giving much larger yields than newly purchased animals from Gujarat showing that Poona is capable of producing as good stock as Gujarat.

Milking without the calves sucking, still proves successful in securing more yield, regular breeding and better young stock.

Besides the milk produced we have an annual crop of thirty heifers from the buffaloes and Sindhi cows. Once our strength is brought up to meet the requirements of the dairy school, we shall be able to supply a limited number to the public as we shall not require so many. I estimate that we must come up to 1,500 lbs. of milk per day for the school purpose. Incidentally, as such a yield will not increase many of our present charges proportionately, the chance of profit will be much greater.

Manjri Sugarcane Station.

The cane for the crop of 1920-21 was planted later than the proper season for the reasons given in last year's report, namely, that owing to the failure of the rains of 1918, only a very small area of cane was kept over on the Farm. This was replanted at the beginning of the monsoon, which in its turn was utilized for planting the plots for 1920-21. The cane of these June seed plots was not ready till March which delay, coupled with severe cold weather, sharply interrupted in March by excessively hot weather, resulted in a reduction of yield from a normal of over forty tons to an average of nearly thirty tons. This was still further reduced owing to first the crusher and later the engine having given trouble so that the crushing was delayed till May. The resulting gul was poorer in quality and less in quantity than normal. The failure of the canals in 1921 has already jeopardized the results of the experiments of three successive years, and has set us back in finishing up certain experiments. Since in 1919-20 no crop was planted. In 1920-21 the crop was planted late as a result of 1919-20 famine. In 1921-22 the crop was set back at the beginning by the failure of canals in 1921.

By means of the Manjri system of moisture saving, the young cane was carried over without anything happening except a slight check in its growth although it went 45 days without irrigation during which time there was a total precipitation of 2·14 inches but only about 15 cents of which was effective.

Even under these adverse conditions there have been some useful results.

The experiment to find out the minimum amount of organic matter necessary for maintaining the Deccan trap soil in the best physical condition has again resulted in showing that with slow irrigation 5,000 lbs. of dry matter is as good as larger quantities in fact it gives a higher yield. This is in conformation of last year's results. Recent research in other places goes to show that an excess of organic matter may cause the soil air to be overcharged with carbonic acid gas which retards root growth. There is also a very important economic feature to this result, for, organic matter is most often supplied as farm yard manure. 5,000 lbs. of dry matter is the equivalent of ten or twelve carts whereas the usual dressing is thirty to fifty and it is not rare to find sixty to ninety put on. Each load is worth for Nitrogen furnished only about Rs. 1-9-0. The Nitrogen in farm yard manure is worth only about one-third of that in other forms or about annas five per pound. When farm yard manure costs more than the above figures which must include carting and spreading charges, it is a loss to put on to cane over ten loads, as cake, fish or sulphate of ammonia supply nitrogen in more useful form.

Green manuring with san is the cheapest way to provide this organic matter. As the quantity necessary is so little, it was hoped that it could be supplied by growing the *San* simultaneously with the cane and thereby saving a season but so far results have not been altogether satisfactory in trying this.

The results of addition of potash and phosphoric acid show that potash does increase the yield but not sufficiently to pay its present cost. Phosphoric acid as superphosphate does not increase the yield.

We continue to get as good crops on a top-dressing that supplies only seventy-five pounds of nitrogen when used with San as with a larger dressing when the slow irrigation methods are followed. Seventy-five pounds of nitrogen is found in either 1,080 pounds or two and a half khandis of oil-cake, 1,500 pounds (twenty-two bags) of fish manure, four hundred pounds (two bags) of sulphate of ammonia. Trials of the various cakes and mineral manures have resulted in showing practically no difference in the comparative value of the various cakes if they are applied according the amount of Nitrogen they contain. Fish is about the same value as cake as a source of nitrogen. Both sulphate of ammonia and nitrate of soda have done better than the organic manures. This is consistent with the results of previous years so far the former manure is concerned but the first time that nitrate of soda has approached other manure in return produced. This is entirely attributable to the shortage of rain and irrigation. If careful irrigation is given, nitrate of soda will evidently do as well as sulphate of ammonia.

The reduction of the number of sets to 4,500 has not decreased the yield.

The variety tests of the year are interesting. This year when there was a limited supply of water many of them are far ahead of Pundia.

Those varieties with which we have been working longer, *viz.*, Red Sports, Manjav and Striped Mauritius, have given yields of thirty-one tons for the last two and forty-four for Red Sports, with Pundia under the same conditions, yielding only twenty-three. Red Sports lodges so that the juice does not give a good gul. If a method can be devised to overcome its lodging, it is the best variety we have. Of the newer varieties, White Transparent stands out with a yield of nearly 30 tons, where Pundia hardly gave 20 tons. The gul from this is good. Three other varieties on a small scale are promising—Waxy Red from Sindh, Mauritius 33 and D 109. A demonstration of the Manjri Farm method was held in December for those of the department and others interested in cane.

The sugarcane class of cultivators was held in January at which twenty-five were present.

J. B. KNIGHT,
Professor of Agriculture.

APPENDIX H.

Annual Report of the Agricultural Chemist to the Government of Bombay, Poona, for the year 1920-21.

During the year under report, *viz.*, from the 1st of July 1920 to the 30th of June 1921, I was in acting charge of the office and laboratory of the Agricultural Chemist to the Government of Bombay.

2. The work under me may conveniently be divided into five sections for report as follows:—

(1) Analytical work; (2) Investigation work; (3) Teaching; (4) General Supervision of the laboratory attached to the Union Agency for manures and m[illegible]e mixing and (5) Water-finder work.

Analytical Work.

3. The routine work of the laboratory was as usual and the number of samples received during the 12 months under report are given below:—

		Total.
Waters	...	75
Soils	...	348
Feeding stuffs	...	86
Manures	...	255
Oil Seeds and Oil	...	6
Fruits	...	42
Dairy product	...	20
Gul and Juice	...	97
Rice Seedlings and Plants	...	64
Vegetables	...	5
Wheat samples	...	96
Miscellaneous	...	52
		1,146

4. The success of the laboratory in filling a public need is best shown by the use made of it by the public, both by actual cultivators and those responsible for industries directly dependent on agriculture. The number of samples received for analysis from the public as distinguished from those from the Government Farms and Departments continues large and was as follows during the year under report compared with that of samples received from the Government Farms and Departments:—

		Government.	Private.
Waters	...	43	32
Soils	...	236	112
Feeding stuffs	...	56	30
Manures	...	193	62
Oil Seeds and Oil	...	1	5
Fruits	...	41	1
Milk and other D. Products	...	9	11
Rice seedlings and plants	...	64	
Vegetables	...	5	
Wheat samples	...	96	
Miscellaneous	...	28	24
		841	305

5. The nature of the routine work done was nearly of the same character as in previous years. The general demand is for examination of and opinion upon the suitability of land for special purposes and opinion on the cause for the deterioration of land; value of waters for irrigation purposes; suitability of particular manures and other problems in connection with cultivation. Examination of feeding stuffs, oils, oil-cakes, fungicides and other similar matters is also included in the usual work of the laboratory.

6. The soil samples of this year included such as those received from the Economic Botanist in connection with his study of Mal land grasses, those from the Rice Expert and Kumta Farms to study the residual effects of manuring, and those from the Arbhavi Farm to study the relation of salts in the soil to the quality of gul produced from the canes grown on those plants. The soil samples from the public required ordinarily the determination of plant foods but there were cases where special points had to be dealt with.

7. One sample of water received through the Divisional Superintendent of Agriculture, Central Division, from a well at Ghodasgaon, a village in Edalabad peta of East Khandesh, was very peculiar. Although the water comes from a trap area far removed from sea it contains 1,072·00 parts of salts per hundred thousand parts of water and the bulk of the salt is magnisium chloride. I am trying to get more information about this water.

8. Manures received from the public mostly consisted of oil-cakes while those received from the Government Department included all types. Night soil samples were received from some Municipalities.

9. Among the cattle food-stuff of this year were a large number of grasses, from Konkan and other places, some samples of silage and other materials. Two interesting samples of Jungle grasses were sent by the General Officer Commanding, the Baroda State Army. When horses are fed on these grasses they go weak in their leg-joints and become night-blind. These grasses have been identified as Andropogon contortus and Anthisteria ciliata. These grasses are ordinarily considered as good for fodder. A careful examination of the grass samples was made. They had no fungus or insect attack and were free from any kind of damage. Examination of the grasses for the presence of poisonous materials gave negative results. As the affected horses recover by the middle of the rainy-season when they begin to get green grass, I strongly suspect that the horses suffer when fed on these dry Jungle grasses through want of vitamines. If care is taken to give a small quantity of green material the horses may not suffer at all.

10. Trials are being made to grow sugar beets on the Nadiad Farm. The samples sent to the laboratory showed a high percentage of sugar in the beets. A separate report is being written on these trials by the Deputy Director of Agriculture for Gujarat. Plantains of a number of variety have been grown in the Ganeshkhind Botanical Gardens and the fruits of all the varieties are being analysed to determine their qualities from the point of their sugar-contents.

11. Among the food-stuff samples received from the public, there were oil-cakes, cakes prepared from plantains and other fruits, milk and gul samples, &c. Some Ghee samples analysed were found to contain animal fats.

Investigation Work.

12. Some questions with regard to the manuring of rice plants were referred to the laboratory. These questions included (1) the use of leaves for manuring purposes, forest and others, which generally go to waste, (2) the difference between the effects of ammonium sulphate and sodium nitrate, (3) the effect of bone-meal and super-phosphate and so on. A few preliminary trials were made during the period under report and further work is being carried out on the lines suggested by the results obtained so far. Mr. D. M. Ranade, Senior Laboratory Assistant, is dealing with these questions.

13. A study of the various chemical constituents of the rice plant at various stages of growth was taken up by Mr. V. J. Atgur to find out their relation with the transplanting age of rice plant and also to determine the time before which all the manures supplied must be available for being utilised by the plants. The same determinations will be done again this year to confirm the results that have been obtained.

14. As indicated in the previous report analyses of waters and soils of the Amalsad sugarcane plot were taken up in connection with the attack of red-rot. There was practically no variation in the quantity of the various salts present either in the waters or in the soils. As there was no red-rot attack last year the cause could not be traced out. A report of the work done has been submitted to the Director of Agriculture, and a programme for the 1921-22 has been prepared to enable us to speak more definitely about the relations between the salts in water and soils on one hand and the attack of red-rot on the other.

15. The work in connection with the improvement of the cardamom crop at Sirsi in North Canara has progressed a good deal during the period under report. It has now been proved that propagation by Rhizomes which was considered to be not possible, has been shown to be possible by the use of heated soil. The crop in the heated soil is nearly twice as good as that in ordinary garden soil. The effects of heating the soil have been studied in the laboratory and amongst other things the chief effect of heated soil on the cardamom plant seems to be due to its enhanced power of ammonification. A detailed scheme based on the laboratory results was prepared for both laboratory and the field work. Field experiments have been started in three places and it is hoped that the results of these experiments will bring the solution of the problem nearly to its final stage. Mr. G. M. Bapat, B.Ag., is appointed from the Sir Sassoon David Trust Funds as a Special Assistant to carry on this work.

16. The chemical side of the *manat* land problems has been comp eted and as it seems to be more within the province of the Soil Physicist, it has been transferred to that officer.

17. The study of the de-composition of the trap-rock by Mr. N. V. Kanitkar, Assistant Professor of Chemistry, is being continued. Due to pressure of work he could not devote much attention to this problem.

18. A sugarcane grower in the Southern Maratha Country had for the last two or three years, great trouble in preparing *gul* of good quality and therefore he applied for help. One of my Assistants, Mr. V. G. Patwardan, was deputed to find out what the trouble was. He made a careful study of problem and showed the cultivator how to get over the difficulty. Some other cultivators have asked for similar help in the next season.

19. The question of the utilization of the Mowhra flower refuse after distillation has been referred to the laboratory. From the trials made here it seems that the wet material soon goes mouldy but if care is taken to dry it well, it can be fed to cattle. Trials with regard to its other uses are on hand and a short report will soon be prepared.

Teaching.

20. I was responsible for the teaching of (*a*) Chemistry to all the three classes of the Agricultural College, (*b*) Geology to the Intermediate Agriculture, (*c*) Chemistry to the short course class and (*d*) Chemistry to the special Dairy Class that was held in the year under report. In teaching I was assisted by Mr. N. V. Kanitkar, M.Ag., B.Sc., Acting Assistant Professor of Chemistry and by Mr. V. G. Patwardhan B.Ag., B.Sc., Acting Lecturer in Chemistry. The teaching work has in the last three years increased very much both on account of the increase in the standard of the Chemistry course and the number of students.

Manure Mixing Factory.

21. According to Government Order No. 7790, dated 27th July 1918, for a loan of the services of a Chemist to the Union Agency with a view to encourage the use of chemical manures, Mr. V. N. Gokhale, B.Ag., was deputed from my laboratory to work at the Union Agency Buildings, from the 1st of July 1920. Mr. Gokhale had to spend some days in fitting up a small laboratory for his work.

22. Analytical work done included samples of manures sent by the Union Agency as well as those used in preparing special mixtures for crops and for field experiments. In all 85 samples were analysed and they are as follows :—

Soils	...	13
Artificial Manures	...	37
Manure Mixtures	...	10
Organic Manures	...	22
Other samples	...	3
		85

The soil samples were chiefly from the plots on which experiments were carried.

23. The crops selected for experiments for the year under report were (1) Chillies, (2) Onions, (3) Potatoes, (4) Lucern and (5) Betel-vine. The experiments were carried on the plots of the cultivators so that they would be convinced of the results obtained under their own observations. Unfortunately the experiments could not be all successfully carried through on account of the scarcity of water which was felt in certain districts. A separate note is being prepared on the results obtained.

24. Manure mixtures were prepared for various crops including vegetables, garden crops, fruit trees, and flowering plants. Such mixtures were sold to the extent of 4 tons in the year under report.

Water-finder Work.

25. This work was transferred to me since November 1920 and Mr. B. M. Joshi, M.Sc., from the chemical laboratory was put in charge of the field tests with water-finder. There is a very great demand on the machine both from the cultivator and the public in general. It is not possible to satisfy this great demand with one man to take the tests. Mr. Joshi, however, tried his best to visit as many places as he could and turned out good work for the season. From November 1st, 1920 to June 15th, 1921, 37 places were visited for 49 persons and in all 213 spots were tested. The table given below will show the details:—

Name of district.	No. of villages visited.	No. of persons for whom work was done.	No. of spots where water currents were indicated.
1. Ahmednagar ...	1	1	3
2. Belgaum ...	3	3	3
3. Dharwar ...	3	3	0
4. East Khandesh ...	6	6	5
5. Nasik ...	2	2	3
6. Poona ...	12	18	10
7. Satara ...	7	12	4
8. Thana ...	2	3	2
9. West Khandesh ...	1	1	1
Total ...	37	49	31

Letters were written to all these people on whose lands tests were taken for information as to whether they got water at the places indicated by the machine. Only 13 persons have sent replies so far. Most of them are going to dig their wells after the raining season. Three persons that have dug wells on the spots indicated have all got water.

26. The following papers were sent to the Science Congress held at Calcutta in February 1921 :—

(1) A note on variation in the composition of milk of individual buffaloes—by D. L. Sahasrabudhe.

(2) A note on the changes produced in heated soils—by D. L. Sahasrabudhe.

(3) A note on the preliminary study of use of Karanj leaves (Pongamia Glabra) as green manure for Rice in Western India—by D. M. Ranade.

(4) A study of chemical changes during the process of ripening of the Mango Fruit—by V. G. Patwardhan.

Staff.

27. Mr. V. A. Tamhane, M.Ag., M.Sc., who was for several years Senior Laboratory Assistant went to England some time ago and returned in December 1920. He has now been appointed as Soil Physicist to Government of Bombay. During the absence of Mr. Tamhane in England, Mr. D. M. Ranade, B.Ag., B.Sc., was acting as Senior Laboratory Assistant and was made permanent in that post in December last. Mr. V. N. Gokhale's services have been lent to the Union Agency to work as Chemist for the Manure Mixing Factory. Mr. B. M. Joshi, who is also a Laboratory Assistant, is deputed for work on water-finder.

I am glad to say that all my Assistants worked very satisfactorily during the period under report.

D. L. SAHASRABUDHE,

Ag. Agricultural Chemist,
to Government of Bombay, Poona.

APPENDIX I.

Work done under the Economic Botanist for the year 1920-21.

Staff.

This year saw considerable changes in staff. The original work of the Economic Botanist has now been distributed between three officers of Imperial grade, namely, the Economic Botanist (Dr. Burns), the Plant Pathologist (Mr. S. L. Ajrekar) and the Horticulturist (Mr. Cheema Singh). Mr. Ajrekar took up his duties on 17th December 1920 and Mr. Cheema Singh, on 21st July 1921. The latter date is outside the year under report but the actual post had been sanctioned and the appointment made in the said year. The other staff has been or will be divided between these three officers. It is not necessary to go into further details here.

Mr. H. P. Paranjpye returned from Mesopotamia on March 29th, 1921 and rejoined his post as Assistant Economic Botanist. A district horticultural officer has been sanctioned and this post will be filled up shortly.

It is unnecessary to give particulars regarding the leave of various members of the staff. It is satisfactory to know that the great variety of subjects attended to by the staff of the Economic Botanist will now receive detailed attention on account of the sub-division of labour. It is also certain that the Imperial Officers themselves will be able to give more personal attention to research. There has been a tendency, inevitable perhaps, for heads of sections to become organisers rather than actual scientists and the new arrangement will, it is hoped, give more time for actual scientific work.

Whether this will be the case or not is doubtful, as under present conditions, administration, in even the smallest concern, claims far too much time.

Mr. S. H. Prayag was transferred from the Economic Botanist's staff to be Cotton-Breeder at Dhulia. His work under the Economic Botanist was always precise and accurate.

Education.

The number of men who specialised in Advanced Botany in their third year of the B.Ag. course was ten. All these passed. The area known as Modi Bag acquired near the College for horticultural teaching has been brought into condition by the efforts of Mr. P. G. Dani of the staff of the Economic Botanist. There was much clearing and similar work to do and the planting of trees is only now in progress. The land was utilised for potato experiments and for the growing of fodder in the year under report. It was all green manured.

A year ago in the report similar to this, it was stated that the delay in the construction of the necessary buildings is a retarding factor. The buildings are not yet constructed, nor are the foundations even dug. This kind of thing is disheartening.

The above men who specialised in Advanced Batony made a tour to study cotton breeding at Dharwar. The arboricultural course was not given this year. It may as well be dropped out of consideration now as apparently it is not wanted.

The horticultural course in Ganeshkhind Garden was given to five students. The stipends sanctioned for "Malis-in-training" were not given as no malis proper turned up for training.

The teaching work at College continues to improve in interest and in efficiency.

As examples of co-operation with the Educational Department it may be stated that the Assistant Professor of Botany Mr. G. B. Patwardhan delivered a series of lectures on nature study teaching to the Training College for women, and that parties of students from that College came on three occasions to see the Botanical and Entomological sections of the College and to visit the Farm.

The Economic Botanist is revising a nature study book for the use of the Educational Department.

Research Work.

Fruits.

This section will in future be reported on by the Horticulturist. In the current year the work done has not been quite so much in quantity as in previous years as one of the members of staff (Mr. L. B. Kulkarni), previously engaged in research work on fruits, has been entirely set aside for advisory and propagandga work. This has increased to such an extent as to demand one man's whole time. It is a matter of great satisfaction

that the public are demanding so much of our assistance in the profitable and highly technical matter of fruit growing.

The publication entitled "The Book of the Mango," mentioned in last year's repor as shortly to appear, actually was published as Bulletin 103 of this department in April 1921. This work resumes all our information up to date on this important fruit. During the year under report various investigations requiring continuous observations during a period of years on certain trees have been carried on. One most important result has come to light. It has been the belief that grafting of mango trees was necessary because there was no certainty of the seedlings coming true. Study of records showed that there was no real evidence of scientific value on this point. In 1914 seeds from known plants were planted to test this belief. Two of these have now come into bearing and have produced fruits differing from the parent plant, thus showing that the old belief was true. The bearing of the other trees is awaited with interest. Extensive experiments in the top-working of old mango trees have been carried out with success and the progress of these trees will be studied.

In the case of citrus, the existing Nagpur orange plantation has been maintained, but the dieback of this variety needs and will receive further study. The navel orange plantation has done fairly well but the variety is not a very good one and some examples of the real Washington Navel are wanted and will be ordered. The propagation of citrus is receiving study and comparison of budding and enarching being made. It is too early yet to dogmatise from the results.

The guava, fig, and pomegranate plantations have been maintained but no special additional work done on these. The guava plants whose roots were exposed last year to study their development in blasted pits recovered even after the severe drying out they received in that process.

In the case of grapes a comparative test was made between Bordeaux mixture, Lime, Sulphur Wash, and a patent mixture known as the "Blighty" Burgundy mixture as remedies against mildew. The Bordeaux was an easy winner. The attack of anthracnose was not serious this year probably due to the dry season. The formation of cork on the surface of fruits is a new disease under study and as also a malady called *kajali* in which the buds are affected and do not open. Information is being gathered regarding these diseases but no definite remedies can yet be suggested.

In grafting experiments it has been shown that the Phakadi scion is not affected as to qualify by the Bhokri stock. The hybrid grape has not yet flowered. Certain new plantations have been made and the foreign varieties which fruited have been described. The process of training Pandhri Sahebi on an extended overhead system has been done on a larger scale with success.

In the case of the banana the second year's results have shown that the artificial manure given produces by far the best results and pays for itself many times over. The banana when well cultivated is a most paying crop and according to our calculations will in Poona yield a net profit of Rs. 300 per acre. Further experiments have been made of banana drying. The next step is the introduction of the system on a large scale provided material and markets are available.

Wild Fodder Grasses.

This subject is dealt with under the head of the Sassoon David Trust Fund Researches.

Canal Weeds.

In 1915 the Economic Botanist was called in by the Irrigation Department to assist them in a study of the aequatic weeds blocking Canals. A study was at that time made of the Godavari and Pravara Canals and a report submitted. The question has this year been re-opened and in collaboration with the Irrigation Department the Mutha and Nira Canals have been studied. Much useful information has been gained but it is not yet possible to give a definite opinion on the factor which determines the presence or absence of weed. There are, however, some very distinct indications and these will be immediately followed up. If we can determine once and for all the factor or factors which really affect the growth of these weeds, it will then be possible to arrange to combat them. In this as in all similar cases exact knowledge is the only possible basis of future action.

Sassoon David Trust Fund Researches.

Financed by this Trust are four researches carried out by men specially recruited for the purpose and working under the Economic Botanist. These are controlled by committees appointed by the Director of Agriculture. The researches are:—

(1) On the improvement of poor grassland.

(2) On the eradication of certain weeds, especially Lavala (*Cyperus rotundus*).

(3) On the improvement of potato cultivation.

(4) On the production of a race of Bajri (Pennisekum typhoideum) more draught resistant than the average races now grown.

The last named has only just been started and there is as yet nothing to report. The other three have been running for a year and much valuable information has been gained. These will now be dealt with separately.

(2) *On the Improvement of Poor Grass Lands.*—This is an expansion of the work done by the staff of the Economic Botanist since 1910 on this subject. The plots in the Government House Compound treated by us have responded remarkably to the treatment now producing a fine crop of good grass in place of the previous spear grass. While this method of reseeding is applicable to small areas, a method that does not involve the laborious collection of seed is necessary for application on a large scale. For this purpose as mentioned in last year's report we leased five acres of the worst possible Deccan land at Kalas near Poona to see what this land would produce if protected from cattle and men. One year's observation has shown us that in the lower and moister areas the best fodder grasses of the Deccan Marwel (*Andropogon annulatus* and *A. caricosus*) grow luxuriantly, and that on the hilly and more shallow parts good perennials are establishing themselves. There is therefore every reason to believe (and future years will show) that the protection for a limited time of these poor grazing land from men and cattle well help in their renovation. A careful Botanical study is being made of this land at Kalas and the land surrounding it in order to get exact data on which to base our recommendations. The main practical difficulty is the devising of some cheap type of fencing suitable to villages.

Observations at Chharodi, Tegur, and Bankapur are being continued. In collaboration with Captain Crawford of the Willingdon Stud Farm, Sirur, experiments are being made in the laying down of grass land for horses there. This is the first year of the experiment and no report can yet be given.

2. *On the Eradication of certain Weeds, and especially Lavala* (Cyperus rotundus).—This work has yielded many interesting observations. The well-known Lavala or nut-grass is a pest of cultivation especially in Gujarat. Its main means of propagation are its small underground tubers. The ordinary tillage implements merely distribute these more widely. Cutting of the tubers merely acts on them as it does on potatoes and makes two grow where one grew before. Even if the total surface of the tuber is scraped off still it can grow. Tubers really exposed to the sun for ten days, however died. Tubers planted too deep exhausted themselves in trying to produce shoots to reach the surface and those whose shoots were repeatedly removed failed to produce new tubers and finally lost their vitality. All this points to a system whereby the top seven inches or so of a field will be kept harrowed to cut the shoots and the tubers below that will die of inability to reach the light. The work is being continued on these and other lines.

3. *On the Improvement of Potato Cultivation.*—This work has, like the grass work, been carried out for some years, in this case by Dr. Mann and his collaborators. The results of their work are embodied in a bulletin now in the Press. Our main objects are to find remedies for the many diseases to which the potato plant is subject. The Plant Pathologist is in collaboration with the potato committee as regards these diseases and has reported on them. The committee concerns itself mainly with the field application of remedies. The study of local varieties has occupied some attention and the committee was instrumental in helping to get Italian seed potatoes last year. Manurial trials have shown the value of a system of chemical manures, and the matter of storage during the hot weather has been the subject of experiment. It has been possible to keep the temperature down to an average maximum of 85·9° F. during May by quite crude methods, but still there has been much loss in storage. This question needs more study.

Miscellaneous.

Mr. L. B. Kulkarni was awarded the degree of M.Ag. by the Bombay University for a thesis on the improvement of grass lands.

Publications.

Author.	Volume.	Year and Month.
Mr. G. B. Patwardhan, B.Sc. ...	"Sunflower as a Forage Crop," Agricultural College Magazine, Volume XII, No. 2.	October 1920.
Mr. G. B. Patwardhan, B.Sc. ...	A Marathi article on "Sunflower as a Forage Crop" in Shetaki and Shetakari, Volume XX, No. 6.	November 1920.
Mr. P. G. Dani, B.Ag. ...	"The Banana Cultivation as practised at Bassein," Agricultural College Magazine, Volume XII, No. 1.	August 1920.

Author.	Volume.	Year and Month.
Mr. T. R. Khadilkar, B.Ag. ...	"Description of the Inflorescence of Amorphophalus campanulatus, B. L." in the Journal of Indian Botany, Volume II, Nos. 1 and 2.	January 1921.
Mr. T. R. Khadilkar, B.Ag. ...	A Marathi article on the Organs of Plants and their Functions in Shetaki and Shetakari, Vol. XI, No. 4.	September 1920.
Dr. W. Burns, D.Sc. and Mr. G. M. Chakradeo, B.A.	"An Ecological Study of Deccan Grass-land" in Journal of Indian Botany, Volume II, No. 3.	May 1921.
Dr. W. Burns, D.Sc. and Mr. L. B. Kulkarni, L.Ag.	"Some Observations on the Roots of Fruit Trees," Agricultural Journal, India, Volume XV, Part 6.	November 1920.
Dr. W. Burns, D.Sc. and Mr. P.G. Joshi, Superintendent, Ganeshkhind Botanical Gardens, Kirkee.	"The Top-working of Indian Fruit Trees," Agricultural Journal, India, Volume XV, Part 5.	September 1920
Dr. W. Burns, D. Sc. and S. H. Prayag, M.Ag.	"The Book of the Mango," Bulletin No. 103, 1920.	April 1920.

APPENDIX J.

Report of the Work of the Plant Breeding Section for the period, 1st July 1920 to 31st March 1921.

Staff.

The late Mr. H. M. Chibber, M.A., held charge of the office of the Plant Breeding Expert to Government, till January 1st, 1921, on which date he died all of a sudden of heart failure. Mr. W. J. Jenkins, M.A, B.Sc., Deputy Director of Agriculture, Poona, was thereupon temporarily appointed in his place to make a detailed report on the then existing condition of work in the Plant Breeding Section. This he had already submitted before I took charge. Ultimately I was appointed to act as Plant Breeding Expert, the charge of which office was formally taken by me on March 11th, 1921. Messrs. S. G. Bhalerao and N. M. Nitimargi, graduate fieldmen, were in charge of Rice and Wheat Works respectively. Three non-graduate fieldmen Messrs. Athalye, Patil and Thakar assisted in the work. Mr. Patil assisted in wheat and the other two in rice. Mr. Athalye resigned his post on 16th March 1921 as he wanted to manage his own lands, and a fresh man was appointed in his place. Mr. Nitimargi went on privilege leave from 29th March to 28th April 1921. The office routine and account work were managed by Mr. Dongre, the office clerk.

Plan and Method of Work.

The plan and method of work practically continued to be the same as last year. Breeding Work on rice, especially by the bulk seed sowing and line selection method, for securing heavy yielding pure strains of Kolamba, was continued at Karjat. The continued absence at this station of pucka office buildings, laboratory and quarters for the staff is being very keenly felt and early attention would have to be paid to this matter if really good work is to be expected. Work on wheat was carried on at the Poona Agricultural College Farm, where however, owing to want of self control over land, labour, bullock service, implements, &c., the preliminary operations could not sometimes be done in time and satisfactorily. There is hence no wonder if the work should suffer under such circumstances. Besides as intimated by the Principal, Agricultural College, Poona, the wheat area on the Poona Agricultural College Farm, will not be available hereafter, as it would be required by the Professor of Agriculture for his own use. It is therefore desirable to have an independent station specially established, where apart from any other consideration the soil at least would be quite suitable for wheat experiments, and irrigation facilities would exist. Work on Bajri, Hulga (Horse gram) and Karala Niger) was carried on both at Manjri and Poona Agricultural College Farms.

Progress of Work.

Rice.—Yield and earliness were the important points aimed at. Heavy yield—With the object of securing heavy yielding strains of Kolamba altogether 122 pure strains of that variety derived from the original bulk seed of 1918 were sown. From rough calculations based in every case on the yields obtained on a small area of 300 square feet, it appears that—

a small	number	of	these	strains	might	yield	4,900-5,500	lbs.	per acre.
a large	„	„	„	„	„	„	3,600-4,800	„	„ „
a still larger	„	„	„	„	„	„	2,600-3,300	„	„ „
and a small	„	„	„	„	„	„	1,800-2,400	„	„ „

and that no strain would yield below 1,800 lbs. per acre.

Taking into consideration the actual yield of the whole area (about 2½ acres) under experiment it has come to 3,340 lbs. per acre. Now even admitting that from some of the very heavy yields given above we may have to make considerable allowance for the probable error which will reveal itself when we grow these strains actually on the field scale, still it will not materially reduce the yields of some of the best strains which it is hoped will be at least about 25 to 30 per cent. higher than those obtained by the cultivator. The cultivator's yields are said to be as under:—

In an	average	crop	year	from	an	average	land	about 1,500	lbs. per acre.
In the	best	crop	year	„	„	„	„	„ 2,250	„ „ „
„	„	„	„	„	„	the best	land	„ 3,000	„ „ „

Regarding the constancy of the yield of our strains for the two years 1919 and 1920, out of 71 strains now selected, each likely to yield over 4,600 lbs. per acre according to rough calculations, all are constant except 20 and even of these 20, 15 strains would not yield less than 2,800 lbs. per acre, which is practically the cultivator's highest limit. Of all the high yielding strains selected so far 8 or 9 strains particularly seem to be the most promising of all. Besides the above, 46 more strains of Kolamba were also selected from fresh bulk seed received in 1919. Similarly 172 samples of bulk seed of Kolamba received in 1920 were grown for further selection.

Earliness.—Two strains of Kolamba numbers 79 and 110 of 1920 are earlier by 35 days than the average period required by the variety. The yields of both these strains seem to have been vitiated this year by what was supposed to be the work of insects. But still their yields were as high as 2,400 lbs. and 1,800 lbs. respectively, which is at least about 90 to 40 per cent. higher than the average yield of the cultivator for his early varieties, *i.e.*, about 1,300 lbs. per acre. Last year, however, these strains had yielded as much as 4,500 and 4,000 lbs. per acre respectively, when they were not spoiled in any way.

In addition to these two points, *viz.*, heavy yield and earliness, one or another of the following useful characters is represented by several strains which have been selected:—

Good tillering represented by 12 strains in all; absence of sterile spikelets represented by 7 strains; strength of straw or freedom from lodging at maturity represented by 11 strains; firm attachment of grains to their pedicels, represented by 14 strains; and resistance to insect attack, represented by 7 strains. If needed some of these characters might be combined together by hybridisation later on:—

Besides the strains of Kolamba 401 strains of non-Kolamba varieties including 299 late and 102 early were also grown. These are a selection of the heaviest yielding and most promising earheads from last year's crop. But as practically the whole attention had been absorbed by the study of the more important Kolamba strains during the year under-report, the non-Kolambas were only grown to preserve their seed for being taken up later on as time permits. These plants were grown without transplantation. They were favourably situated as regards space and manure and under these circumstances they have proved exceptionally vigorous and very productive. Their tillering power in particular has been remarkably high. It is proposed to continue further testing with these strains as time permits. A series of single plants of both the Kolamba and non-Kolamba strains were bagged in time during the flowering season to prevent any possibility of cross fertilisation, as they were intended for seed purposes. As a result of bagging their seeds have not set properly, however, though the panicles were large. Still their seed has been preserved for sowing for the coming season.

Crossing.

Several crosses were successfully made by the late Mr. Chibber and Mr. Bhalerao and the seed obtained has been preserved. The object of this work was to combine earliness and fine quality of grain. No. 79, an early strain, and No. 27, a fine strain, were experimented with. The economic value of these crosses will be tested next season.

Storage.

All the seed from the experimental series of this season mentioned above has been carefully preserved in a rat proof store and adequately labelled. Most of the samples are in a sound healthy condition. But a few only have been infested with the storage moth of paddy. Attempts would be made from the next year to have all the seed fumigated once or twice to get rid of this moth.

Wheat.

Locality.—Poona Agricultural College Farm, where irrigation was given only once in December to most of the plots.

Sowing.

Five different series of wheat experiments were sown at the beginning of the season. These are distinguished under the following heads:—

(*a*) Pure sowings. (*b*) Singles. (*c*) Specials. (*d*) New dry seed and (*e*) Bulk sowings.

(*a*) *Pure Sowings.*—After the harvest of the crop of 1919-20 the different strains were examined in the laboratory and a reduction of their number was made to a considerable extent. Thus out of the 1,276 strains then grown only 369 were preserved for future culture. The nature of the seed as well as the field characters were taken into account in selecting the 369 strains. These comprised the pure sowings of this year. Where seed was available duplication of the plots under each number was also done. This duplicate series was not irrigated at all to see how it compared with the one that was irrigated.

(*b*) *Singles.*—Two best plants of each of the 369 numbers above mentioned were selected for further separate culture on pure line basis. The seed of one was planted and of the other stored for comparison.

(*c*) *Specials.*—In 1919-20, 60 numbers either from the 369 above mentioned or those not included there were selected for special culture on consideration of any special character shown, such as good tillering capacity, vigour of growth, large

size and compactness of the earhead, period of growth, strength of straw, absence or intensity of wax or its later development, dark colour of leaves, their broad or narrow nature, &c. Each of these 60, numbers showed either one or the other of the above mentioned characters.

(*d*) *New Dry Seed.*—The remainder of the seed of the dry plants from the Nagar and Nasik districts which could not be grown in 1919-20 was sown this year. There were 550 numbers under this heading and several of them showed one or more of the important characters.

(*e*) *Bulk Sowing.*—Certain samples of seed obtained in 1918 and not sown then were sown this season. There were 69 such samples, part of which had already been grown before. But with regard to the remainder further investigations seemed advisable. Numbers 1 to 46 of these were sown without grading. But Nos. 47 to 69 were sown after grading and removing the poor sorts. Some plants from these 69 numbers have been selected and their characters noted.

Among the pure sowings the following important points were noted and notes regarding plants possessing them were taken.—(1) *Loss of chlorophyll*—Number 289 gave some white plants which died soon after the food material stored in the seed got exhausted. Number 44 from the special groop also gave a few yellow plants which similarly died soon. Both these numbers had shown the loss of chlorophyll during the previous year also. (2) *Strains of Kala Kusal*—About 6 strains of Kala Kusal each having its own peculiarity were observed. No. 275 had brownish glumes (an ordinary Kala Kusal has always white glumes). No. 276 had light yellow seed. (This is supposed to be the best seed colour.) No. 277 had wax-less glumes. No. 278 was very vigorous. No. 279 was of the ordinary Kala Kusal type. No. 280 had strong straw. (Kala Kusal is generally weak stemmed). (3) *Colour of glumes*—In wheat there are 3 or 4 types of the colour of glumes, white, yellow, red or a various combination of all these. A sort of a positive correlation has been observed to exist between white colour of the glumes and the capacity of the plant to have vigorous growth, good tillering and high yield, *e.g.*, Nos. 193, 212, 217. (4) *Absence of wax*—Generally when the earhead emerges from the sheath the plant develops wax on the sheath and on exposed parts of the spikes. It was noticed that some plants were absolutely free from wax while certain others developed wax at a later period. Here again a sort of a positive correlation was observed to exist between the absence of wax and the capacity for vigorous growth, good tillering and strength of straw, *e.g.*, Nos. 157 and 284. Absence of wax seems to be a hereditary character, for, last year also these strains had no wax. (5) *Bright leaves*—It was noticed this year that when seen against light, certain strains show a brightness in their leaves. They seem to be always vigorous in growth, pretty good yielders and the seed of some of these is also bright in appearance. If this correlation is established, it would be possible to foretell the nature of the seed even in the seedling stage of the plant. Several of such bright strains have been noted. Of these strains a certain number had bright seeds last year also. (6) *Strength of straw*—Certain numbers can stand upright even after the crop is fully ripe, while certain others lodge. Some of the best numbers of the former type have been noted. (7) *Earliness*—Nos. 146, 168, 171 and 267, flower in 8-9 weeks' time. These are some of the best strains as they are not only early but also good yielders. They are characterised with excellent tillering capacity and vigorous growth. (8) *Heavy yield*—Heavy yield is associated with even and vigorous growth, good tillering capacity, broad flags which are generally ascending or horizontal even after ripening, good height, and large size and compactness of the earheads. Some of the heavy yielding strains and their yields are—

No.	Yield per acre.	Remarks.
131	1,633 lbs.	Yields are calculated on the basis of yields obtained on 100 square feet. The yields of irrigated wheat as obtained by the cultivator generally are about 1,600 lbs. per acre, while those for dry wheats are about 1,000 lbs. per acre. As already said in the case of rice the above yields might have to be reduced to some extent to make allowance for the probable error which would reveal itself when these strains are sown on a field scale.
162	2,067 „	
168	1,600 „	
183	2,067 „	
193	1,742 „	
210	1,680 „	
212	1,772 „	
217	1,742 „	
227	1,920 „	
248	1,742 „	
254	1,742 „	
258	1,662 „	
278	1,530 „	
283	1,742 „	

(9) *Rare Strains in Khapli*—Khapli variety has glabrous glumes; its earhead is always flat and dense. One Khapli strain has been observed to have hairy glumes. Its

awns also turn back when dry just as in Kala Kusal. This combination of Kala Kusal character in a Khapli earhead is very important as Khapli is supposed to be rust-resistant.

Bajri.

Locality—Manjari Farm.—The seed of all the 470 earheads selected and classified the previous year was sown at Manjri Farm in the month of July. About 20 samples of new bulk seed were obtained this year from Belgaum and Kaira districts. These bring the total number to 490. Each of these had three rows 28 feet long assigned to it. This sowing was duplicated in all cases where seed was available. Notes were made as usual of all the important features of growth. It was observed that plants in the same number differed very widely from each other, Bajri being a cross fertilising crop. At the time of harvest selection of earheads was made from the middle row of each number. Some of the numbers which showed poor growth and which were not very characteristic were rejected at the time of selection. Similarly seed could not be obtained from some numbers which were spoiled by birds as they happened to be at the end of the plot and easily accessible to them. Thus the rejected strains came to 103 in all. From each of the remaining numbers about three or four typical heads were taken. The point in taking the earheads from the middle rows only was to lessen the effects of cross fertilization. The earheads from each number were bundled together properly labelled and carefully stored for future work.

Karala.

As in Bajri, this being a cross fertilising crop not a single number bred true. All of them split up in a various degree of mixture and so only 19 plants showing marked botanical variations were given attention. All these plants were bagged but the trial was fruitless as no bagged inflorescence set any seed. However the seeds from other fruiting branches which were not bagged have been collected separately and their respective characteristics noted. The numbers from which the plants were selected need not be taken into account as apparently every number showed a representative mixture of all the strains.

Hulga.

The study of this crop was already discontinued during the previous year.

Poona, 6th May 1921.

R. K. BHIDE,
Ag. Plant Breeding Expert.

Report of the Plant Breeding Expert for the months of April, May and June 1921.

Rice.

To test the constancy of the yield and earliness of our respective selected strains of rice, their seeds were sown in several series in June 1921. The seedlings raised will be transplanted in separate line cultures as well as on extensive scale. Side by side with these, some seeds obtained from the local cultivators were also sown and will be similarly transplanted in lines and on extensive scale. This would not only give us a chance to test our strains again, but it would also give us a clear comparative idea of the yields obtained from both under practically uniform conditions; and as the strains are now grown on more extensive scale than before the yields shown by them this year would be more nearly reliable.

Wheat.

Seeds from one whole plant of each of the promising strains of wheat were set asid for sowing purposes. I hope to grow them under better conditions this year than before as a better plot of ground at the Ganeshkhind Botanical Gardens has been placed at my disposal for trials with wheat. Last year the plots were grown both as dry and irrigated and it was found that the drier the conditions the more shrivelled was the seed; on the other hand the more the waterings given, the greater was the tendency of the plant to have starchy and mottled grains.

Bajri.

At the suggestion of the Director of Agriculture, all Bajri material has been handed over to the Economic Botanist to Government for selecting drought resistant strains of that crop.

Poona, 26th July 1921

R. K. BHIDE,
Ag. Plant Breeding Expert.

APPENDIX K.

Report of the work done under the Plant Pathologist to Government of Bombay, Poona, for the year 1920-21.

I took charge of the newly created post of Plant Pathologist for the Bombay Presidency on 18th December 1920. The following staff who had been previously working under the Economic Botanist to Government of Bombay, Poona, were transferred to the Section of Plant Pathology with effect from 1st January 1921:—

Mr. G. S. Kulkarni, M.Ag., Assistant Professor of Mycology.

Mr. M. N. Kamat, B.Ag., Assistant Mycologist.

Mr. B. R. Tonapy, Laboratory Assistant.

Messrs. S. A. Jamadagni and S. K. Gaikwad, Temporary Non-graduate fieldmen (for Koleroga work).

Mr. G. G. Karlekar was appointed clerk to the Plant Pathologist with effect from 1st February 1921.

The work which the above mentioned Mycological Staff had already in hand was continued and included investigation into diseases of crops and the usual teaching work in plant diseases at the Agricultural College and the spraying campaigns against the Koleroga of betelnuts in North Kanara and against the powdery mildew of Jeru (Cuminum ciminum). A separate report has been already submitted by the Assistant Mycologist on the Koleroga campaign and the spraying against Jeru mildew again proved beneficial as shown by an excess of 50 lbs. in yield per acre in the treated plot as against the untreated plot at Nadiad in one experiment. The results of investigational work in summary are as follows:

The Murda disease of Chillies.—The study of this disease has shown that the same mite which causes the "Tambera" disease of potato is responsible for this disease too. The disease is of wide occurrence and does considerable damage in certain years. Preliminary spraying trials with lime sulphur wash showed that the disease could be checked completely if the spraying is given at the right moment. A Zinnia disease too, which was a puzzle till now, has been traced to this mite. An account of the investigations on this disease was submitted to the Science Congress held in Calcutta in 1921. Quite recently, garden varieties of Salvia have also been found to be liable to attack by the same mite.

Smuts.—The experiments on the smut on Nachani (Eleusine coracana) to see whether the smut is seed-borne or not, did not lead to any definite results. Smut did not appear either in the plot sown with seed infected with spores or in that sown with the seed treated with two per cent. copper sulphate solution. The experiments will be repeated in the coming year. Smut (Ustilago paradoxa) on Banti (Panicum frumentaceum) recorded for the first time in 1919 from Sind where it seems to be of common occurrence, was studied. Field experiments conducted in Sind showed that the smut is seed-borne and could be easily prevented by copper sulphate treatment. The results of this investigation will be published shortly. The experiments with the *milo* variety of Sorghum (reputed to be resistant to smut in America) confirm the last year's results, *viz.*, its extreme susceptibility to the *loose* smut (Sphacelotceca hruenta Kuhn, Pot). A record of this observation will be shortly published in Phytopathology.

A new Fusarium of Potato referred to in the last year's report, on further study, seems to be the species oxysporium. It agrees in its morphological characters and in the symptoms it produces on its host with the description of the Fusarium oxysporium given by R. J. Haskell in Phytopathology, Vol. 9, No. 6 of 1919. This year's experience shows that it is one of the very distructive diseases of the potato crop causing a large percentage of deaths of plants in the field. The crop was raised from the Italian seed recently imported. The consignment of seed tubers on arrival in the Bombay Docks on examination was found to be quite free from the Wart disease, but was badly attacked with Fusarium oxysporium. At the time of planting, therefore, a very rigid selection of tubers was made by rejecting all those tubers that showed brown discoloration at their stem end in their interior. Even with this selection the crop showed much disease in all the fields.

Observations on the diseases of the potato crop in the field and in storage have been continued in collaboration with the Potato Research Committee and have resulted in the discovery of one more fungoid disease of the growing potato crop—a powdery mildew (Oidiopsis sp.). This did considerable damage in the crop at Khed and Chakan. This is probably the first record of this fungus on this host in India.

A programme of work on cotton wilt to be done in collaboration with Mr. Kottur Cotton Supervisor, S. D., has been drawn and will be taken in hand as soon as possible in the next season.

Preliminary observations have been made on a disease of the Onion probably due to a species of Macrosporium which threatens the cultivation of this crop in certain parts of the Konkan tract where it has been recently introduced; and also on a peculiar leaf-spotting of the sugarcane which was suspected to be contagious and capable of doing much damage to the crop. Fortunately, the latter disease did not spread and although the cause of it is still a msytery, some useful information has been gained.

Details of work on the Red-Rot of sugarcane in the Amalsad tract have been settled by the Assistant Professor of Mycology in consultation with the Agricultural Chemist and the Deputy Director of Agriculture, N. D., Surat.

210 specimens of diseased plants were examined and reported on. Of these a disease of Betel-vine leaves known in Thana and Kolaba districts under the name" Sara" and a die-back disease of the Camphor may be mentioned as of some interest. The betel-vine disease appears to be due to a species of Synchytrium and the Camphor disease to a Diplodia sp. The Diplodia has been brought into culture and is under further study. It is hoped that this study will throw light on many other die-back diseases of fruit trees like mango, guava and citrus which are from time to time complained of in this Presidency.

Messrs. G. S. Kulkarni, R. K. Bhide and myself attended the Mycologists' Conference held at Pusa in February 1921 and also the Indian Science Congress in January 1921 at Calcutta. Before this Congress Mr. Kulkarni read two papers, one on the "Murda (leaf curl) Disease of Chillies" and the other on the "Conditions influencing the Distribution of Jowar Grain Smut in India" and I read a paper on the Wilt Disease of Cotton in the Central Provinces giving the results of my work as Mycologist to the C. P. Government for six months previous to my return to the Bombay Department of Agriculture.

Every member of this staff has toured as occasion demanded in connection with his research or advisory work.

S. L. AJREKAR,
Plant Pathologist to Government,
Bombay Presidency, Poona.

APPENDIX L.

Annual Report of the Soil Physicist to the Government of Bombay, Poona, from 15th December 1920 to 30th June 1921.

1. *Creation of the Post.*—The creation of the post was contemplated as early as the beginning of the war and Dr. Russell, Director of the Rothamsted Experimental Station, England, was consulted as to whether he would be able to train a man in Soil Physics if one was deputed from here. He however advised the Government not to send a man for training in Soil Physics till after the war. On the termination of the war I was selected (*vide* Government Order No. 12744, Revenue Department, dated 25th November 1919) to undergo training in Soil Physics in England and on my return to India I was appointed Soil Physicist to the Government of Bombay from December 15th, 1920.

2. *Scope for Work.*—The scope for research in this branch is very large. In the Bombay Deccan where famine is frequent research on the line of increasing the total moisture content in a soil and making it more available to the plant is urgently needed. This includes a number of problems such as —

(*A*) Problem of preventing loss of water over the surface of the soil.

(*B*) Problem of making soil absorb more readily the water that falls on it.

(*C*) Problem of checking loss of water by evaporation after it is absorbed.

(*D*) Problem of drainage (at certain times) as a waterlogged surface layer may be the principal obstacle to absorption of water.

(*E*) Problem of retentiveness of soil particles which may depend upon—

(*a*) proportion of fine matter,

(*b*) proportion of colloidal matter,

(*c*) temperature, and

(*d*) drainage.

On the solutions of these problems depends largely the increase in the yield of food crops in districts of scanty rainfall.

Research on the above lines is being undertaken this year on the typical soil of the Sholapur district and will be continued if facilities be provided for such research.

There are besides the above a number of problems relating to soil condition on which work is needed from this section of the Department. A number of cases are known (such as *band* disease of the Betelnut) where fruits drop off from the plant before they are well developed. No cause has yet been found, so far as is known to me, but the apparent cause attributed is bad physical condition of the soil. There are instances wherein the same field plants grow very vigorously on one portion of the field but on other portions of the same field which receive similar treatment so far as manure, tillage and waterings are concerned, plants attain a certain height and then wilt. This is due in most cases, as was found at Gokak, to the bad physical condition of the sub-soil where a hard pan was struck at about three feet below surface of the soil. Such portion of the field is not good for deep rooted crops like cotton but is fairly good for crops like Jowar whose root system is not so deep as that of cotton. Such and a number of similar other problems are awaiting solution.

3. A Conferrence of Chemists and Bacteriologists was held at Pusa in February 1921 where I was allowed to be present. The question of the mechanical analysis of soils was discussed when it was found that almost each province had its own method of doing the mechanical analyses of soils especially the preliminary treatment of the sample of soil before submitting it to the sedimentation method. It was therefore thought fit to appoint a committee to critically examine and recommend a suitable method of mechanical analyses of soils. I was appointed as one of the members of that committee. My special work in this connection would have been to find out the co-relations of the result of the mechanical analyses with other physical constants.

Another committee was also formed for preparing and circulating details of the standard method to be adopted for analyses of fertilizers and for circulating proposals for the determination of the ordinary soil constituents. I was also appointed one of the members of this committee.

Membership of these committees was accepted by me on the hope of getting sufficient scientific staff under me but as not a single graduate assistant is given to me, I am afraid, I cannot undertake to do sufficient work to justify my position as a member of the Pusa Committees and I cannot directly take active part in the scientific progress of Indian Agriculture taken as a whole.

4. In the Kolaba and Thana districts a large area (several thousands of acres) known as Manat land is lying waste owing to the very sticky character of the soils during rainy season and its extraordinarily stiff and hard nature during the dry season. An experimental station has already been opened at Varsoli near Alibag under the Deputy Director of Agriculture, Konkan, who has the charge of the field experiments to improve the physical condition of the soil. As the root-cause of the bad nature of the soil lies in the colloids of the soil, it is essential that a large amount of work is necessary in the laboratory to guide the field experiments. The problem was in the charge of Agricultural Chemist till now but as most of the work is physical the problem has been transferred to me by that officer. I am however handicapped for want of staff and can only do slow and gradual progress in the work.

Manat soils are very retentive soils. In the hottest part of the year when there was no rain for seven to eight months previous to taking the soil samples the moisture contents of some of the worst Manat lands were found to be from 10-15 per cent. These soils seem to be more adapted for Rabi cultivation than Kharif cropping especially if aided by well-sinking.

5. Teaching of soil physics to the Intermediate Agricultural students is given to me as a part of my duty in addition to research work and I am preparing lectures on soil physics.

6. *Staff.*—The scientific staff under me consists of only one non-graduate assistant Mr. B. M. Ruikar, who however, having studied up to the B. A. class has been doing the scientific work with intelligent understanding and has made himself indispensible to me. It is, however, to be regretted that no graduate assistant is given to me to whom I can entrust in the interest of the Department, some of my work.

V. A. TAMHANE,

Soil Physicist, Bombay Presidency,
Poona.

APPENDIX M.

Annual Administration Report of the Deputy Director of Agriculture, for Animal Breeding for the year 1920-1921.

Mr. Edward John Bruen held charge of Animal Breeding operations during the whole year. The Deputy Director was on tour for 142 days in the year. All the districts where cattle breeding is carried on to any extent were visited. Advice was given where necessary. A Dairy Scheme together with plans costing 37 lacs was prepared for Lieut. Patwardhan and land was selected which was thought most suitable to run such a Sheme successfully. He was an Examiner at the Final B. Ag. Examination held during the year. He also assisted the Professor of Agriculture giving lectures in Cattle and Cattle Breeding. The year under report being a bad year, famine operations were started to save as many cattle as possible in Poona and Nagar districts, separate reports being submitted for each. This work was in charge of the Deputy Director for Cattle Breeding. Advice was given as to how such camps ought to be conducted in the Sholapur and Bijapur districts. All charitable cattle camps were visited and necessary advice given.

The Cattle Breeding Farms at Chharodi and Bankapur were visited as thought necessary. Separate reports for these are attached. A complete detailed scheme was submitted for a Fodder Farm and two Bull Breeding Farms to be started at Pavagarh, Halol taluka in the Panch Mahals.

District Work.

During the year under report, three Divisional Inspectors of Cattle Breeding were sanctioned, two appointments were made, one for the N. D. and one for the C. D. only, towards the end of the year was a man appointed for the S. D. as funds did not permit of any work being done in this Division.

Mr. C. M. Bhatt held charge of Divisional Inspector of Cattle Breeding, N. D., for a short period. The post apparently did not suit him and he resigned. No appointment was made in his stead as partial famine conditions prevailed, and therefore no progress could be made.

Mr. G. V. Hardikar, B.Ag., held charge of the C. D. during the year. He visited all the talukas in his jurisdiction where cattle breeding is carried on. Lectures were delivered and advice given in every village visited. Premium bulls were inspected periodically as thought necessary. All cattle fairs were visited by him. Famine conditions prevailing practically all over the C. D. very little progress could be made. During the last half of the year he was deputed on Cattle Famine Work. Mr. G. V. Hardikar worked exceedingly well during the year.

Premium Bulls.

The object of this Department is to improve the cattle of the country. By the term improvement we not only mean improving the physical condition of the cattle but we also are aiming at improving their early maturing qualities, regularity in breeding without in anyway impairing the present qualities of hardiness and immunity to diseases. To achieve this end, bulls of known pedigree are being bred on the Government Farms at Chharodi and Bankapur having as far as possible the desired qualities. At present these two Farms only provide for the two breeds, *i.e.*, the Kankrej and Amrit Mahal or Mysore breed. For tracts where other breeds are bred, we have at present to resort to purchasing the most likely bulls. This system is not what is desired but until Farms are established for the other breeds, it is the best that can be done.

During the year premium bulls were put out as shown in Statement "A."

I. The number is very small but nothing better could be expected owing to famine conditions prevailing practically all over the Presidency.

No less than 27 applications were received for bulls from the Maswad breeding tract alone, and since in past years most work was done in this tract by my predecessor; it was thought that the money at my disposal which was very small ought to be used here, but unfortunately owing to famine conditions prevailing, the villagers were not prepared to take the responsibility of looking after a bull. However even with these adverse conditions the number put out exceeds that of the previous years. The breeders are beginning to realize the great necessity of using a good bull.

Cattle Shows.

Cattle shows are held in 30 villages in different parts of the Presidency where cattle breeding is carried on. The idea of these shows is to collect together the breeds where

intelligent comparison of different cattle may be discussed and by offering prizes to encourage the breeding of good cattle. During the year under report unfortunately owing to the famine almost all the shows had to be abandoned, although most of these shows had been arranged, Committees appointed, &c., which had to be cancelled at the last moment. The District Local Boards were keenly interested and in many cases had offered very substantial financial help. Two shows were however held, one at Chharodi which was a great success and was well attended, the breeders taking a keen interest in all the proceedings. A show was held at Jalgaon as a trial to see what could be done to improve the cattle in this district. The show was a success; from this point of view it was well patronised.

STATEMENT A.

Statement showing Details of Premium Bulls put out in 1920-1921.

Date of disposal.	Village.	Taluka.	District.	Kind.	Remarks.
8- 9-20 ...	Bhadkodsa ...	Ankleshwar ...	Broach ...	Bull.	
8- 9-20 ...	Jitali ...	Do. ...	Do. ...	Do.	
14-10-20 ...	Sarbhon ...	Bardoli ...	Surat ...	Do.	
14-10-20 ...	Do. ...	Do. ...	Do. ...	Buffalo-bull.	
29-11-20 ...	Mota Varachha ...	Chorasi ...	Do. ...	Bull.	
28- 9-20 ...	Kabilpur ...	Do. ...	Do. ...	Do.	
28- 9-20 ...	Do. ...	Do. ...	Do. ...	Buffalo-bull.	
31-12-20 ...	Mangewadi (Yelmar) Sangola.	Sangola ...	Sholapur ...	Bull.	
27- 1-21 ...	Hangni ...	Man ...	Satara ...	Do.	
26- 2-21 ...	Sadalga ...	Chikodi ...	Belgaum ...	Do.	

Annual Report of the Northcote Cattle Farm, Chharodi, for the year 1920-1921.

Mr. M. M. Desai held charge of the Farm for the year. Mr. D. S. Patel was Assistant Manager.

Object of Farm.

The object of this Farm is to breed pedigree stock of Kankrej breed of cattle. Bulls are bred and put out on premium system into villages that are desirous of improving their cattle. To achieve these ends it has been found necessary to eliminate a good number of the existing stock which do not conform to the typical Kankrej type. The first step taken in this direction has been to discard all breeding bulls that were purchased from outside and to substitute them with bulls of known pedigree either from the Farm itself or from the Government Farm, Surat. Close observations are now being kept on the female stock and any producing calves not typical will be removed from the breeding herds.

Season.

The monsoon was not what really could be called good, although the total rainfall 28 in. 18 cents which was recorded is very nearly the average for the district. The monsoon broke early on the 16th May with a heavy down pour accompanied by a severe storm. The majority of the rain fell in late June and early July and during the first week of August, 2 in. 37 cents were recorded; after this the Farm had no rain with a consequence that crops were badly affected.

Crops.

Six varieties of Jowar (sorghum) were sown to ascertain the best suited to the tract. In this trial two South Gujerat varieties Perio and Sholapuri gave the best results; Sundhia next with Nilawa the Deccan variety; fourth Chhastoo, a local variety did worst of all. This experiment however is not by any means a fair test as Perio and Sholapuri were much better situated in being on higher land than the others and hence did not suffer from the excessive rains in July. This experiment will be carried on for another year. Statement "B" shows the area sown, yield per acre, cost of production, &c. No attempt is made to grow Jowar (sorghum) fodder in the tract owing to the grass hopper pest. The Farm would have suffered the same fate as the village crops, had not precautions been taken. Light traps and hopper bags were used with great success by the Manager and with a total expenditure of Rs. 3-12-0, this pest was eradicated with the result that we had "bumper" crops as will be seen in Statement "B".

Hay-Making.

Hay-making operations were started in October 1920 and finished in February 1921. The crop was not a very good one owing to the heavy rain in July, when a considerable area was flooded. However 888,500 lbs. of fodder was harvested at a total cost of Rs. 2,426-7-3 which works out at Rs. 2-11-8 per 1,000 lbs. Hay-making by tractor power was tried and although the mowing machines were not suitable for a tractor, very fair results were obtained.

Live-Stock.

The live-stock on the Farm have been in very good condition all through the year. During the year 65 male calves and 60 female calves were born, as against the same period of the previous year 36 male and 32 female calves were born, a very appreciable difference. During the year 188 cows were covered as compared with 127 the previous year. A better result in calving percentage is expected the next year. The year was started with a total of 603 cattle and ended with 647, an increase of 44. During the year 5 bulls and 2 buffalo-bulls were put out on the premium system.

Disease among Cattle.

The total casualties on the Farm were 69. Hæmorrhagic Septiæmia accounted for 13 animals, 20 old cows and bullocks died and 12 calves out of a total of 125 born, died. Six died of snake-bite and 18 from other causes. Rinderpest made its appearance towards the close of the year.

Improvement.

During the year the Farm was divided into paddocks by fencing with $6\frac{1}{5}$ miles of wire fencing. This will now permit of herds being kept separate, and besides allow of different areas being cut and grazed in rotation. Two pucca silo towers were erected

making three in all. Six masonary troughs were built. A small calving shed was erected departmentally. A store-room much needed was completed. A great difficulty on the Farm is water. To overcome this a 3" bore is in progress in the Farm well, which promises a good pure supply both for the staff and the cattle.

The Kankrej as a Milk Producer.

During the year under report a few of the cows were milked, the idea of this experiment being first to see how the Kankrej does as a milk producer, secondly to see if the calves would not thrive just as well on other cheap concentrate foods as on milk and to sell the milk or cream which is a very much more costly feed. The experiment however was started late in the year and no appreciable results have yet been noticed; statement "E" will give some idea of the milking capacity. The cattle have had no special treatment, and supported their calves well during this experimental period. There is no doubt the lactation period is lengthened a great deal with the result that the calf receives its mother's milk for a longer period.

Mr. M. M. Desai has managed the Farm exceedingly well. He deserves great credit for the cultivation and fodder grown under very adverse condition. Mr. D. S. Patel, the Assistant Manager, was of great assistance to Mr. Desai in helping to make a success of this year's work.

STATEMENT B.

Statement showing the Yield, &c., of different Crops.

Name of variety.	Area.	Total yield in lbs.		Yield in lbs per acre.		Cost of production per acre.	Value of production per acre.	Net profit or loss per acre.	Remarks.
		Principal product.	Bye product.	Principal product.	Bye product.				
Old Field.	A. g.					Rs. a. p.	Rs. a. p.	Rs. a. p.	
Perio ...	1 38	36,120		18,523⅓		52 14 7	742 2 5	+689. 3 10	
Sholapuri ...	2 3	39,850		19,200		52 14 7	768 0 0	+715 1 5	
Sundhia ...	7 18	90,600		12,161		52 14 7	486 6 5	+433 7 10	
Utavli ...	2 5	17,920		8,433		52 14 7	329 3 7	+276 5 0	
Chhasatio ...	6 14	40,858		6,155		52 14 7	246 0 0	+193 1 5	
Nilwa ...	4 22	40,884		8,986		52 14 7	359 6 5	+306 7 10	
Malwan ...	2 0				Failed	for want of	rains.		
Math ...	2 22	8,400		3,294		52 14 7	82 5 6	+ 29 6 11	
Udid ...	1 34	9,600		5,189		52 14 7	129 7 4	+ 76 8 9	
Well Field.									
Irrigated Sundhia.	0 20	4,536		9,072		198 3 4	118 0 0	- 80 3 4	
Guar ...	1 20	3,240		2,160		32 3 4	54 0 0	+ 21 12 8	
New Area.									
Malwan and Nialo.	32 0					32 10 0			Standing crop fed to cattle, Nialo was, a bit superior in stand to Malvan.

STATEMENT E.

Name.	No.	Date calved.	Date of commencement of work.	Monthly Yield.				
				December.	January.	February.	March.	Total.
				lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.
Chandi ...	37	11 4 1920	December 1920.	123 0	203 12	240 4	295 4	862 4
Pirani ...	18	11 12 1920	Do.	44 4	117 4	292 8	394 0	847 0
Nami ...	53	22 5 1920	Do.	53 8	120 4	269 12	375 8	819 0
Haroli ...	130	3 8 1920	Do.	108 8	236 12	323 12	371 0	1,040 0
Vigli ...		27 12 1920	Do.	10 4	161 8	284 0	415 12	871 8
Sanduri ...	28	16 7 1920	Do.	93 12	215 4	216 18	233 12	759 4

Annual Report of the Cattle Breeding Farm, Bankapur, for the year 1920-1921.

The proposed Cattle Breeding Farm started breeding operations on the 27th of June 1920. The object of the Farm is to breed pure bred bulls of one of the types of cattle found in Mysore State, known generally as the "Hallikar breed". This breed was selected as it is most fancied by the cultivators being useful both on the road and in the field. This farm fills a long felt want of the cultivators who at present pay very high prices for bulls purchased in Mysore State.

Situation.

The Farm is situated in an old fort comprising some 118 acres of good grazing land adjoining the village of Bankapur, 12 miles from Hattimattur Railway Station on the M. & S. M. Railway in the Dharwar district.

Cattle.

To obtain the nucleus of a breeding herd, the Deputy Director of Agriculture, for Animal Breeding, visited Mysore State and with the help of the Mysore Department of Agriculture purchased the following stock:—

Adult cows	... 22 (of which six had calves at foot).
Heifers	... 9
Stud bulls.	... 2
Bullocks	... 4

During the year 11 male and 8 female calves were born. One female calf died being killed by a panther and one of the heifers died, cause unknown. Eleven services have been recorded during the year. The attached Statment "C" shows the cattle purchased, those now present together with their values. The cattle in the first instance were all young with the exception of two and their values have naturally been appreciated. The value of the cattle has been adapted from prices ruling at the time cattle were purchased in Mysore State.

Health.

The cattle have been kept in very good health during the year. An out break of Foot and Mouth disease appeared on the 23rd of March 1921; no death however occurred and no great harm was done except that for the time the cattle were run down in condition from which they recovered very rapidly.

Hay-Making.

Approximately 171,160 lbs. of hay were harvested at a total cost of Rs. 535, *i.e.*, Rs. 3-2-0 per 1,000 lbs.

Water Supply.

The water supply on the Farm is anything but satisfactory. Special men had to be employed at a great expense to draw water from a neighbouring tank for the cattle. To obviate this, a site was selected and bored to a depth of 200 feet. It is hoped this will supply all the Farm requirements.

Buildings.

The Farm buildings proper have not as yet been completed. The cattle had to be housed in temporary sheds.

Improvement.

The Farm site was covered with prickly pear and lantana. This has been all cleared at a total cost of Rs. 560. The land has been cleared and levelled as much as possible, and all debris from old buildings removed. A small paddock of woven wire fencing was constructed at a cost of Rs. 450. Two water troughs were built at a cost Rs. 430, as no provision was made in the original plans for these. A walled in-compound was started with a lean to shed to accommodate the young sucking calves.

STAFF.

The management of the Farm has been in several hands during the year. Towards the close Mr. A. B. Gadagkar, G.B.V.C., was appointed to the post. He promises to do well.

STATEMENT C.

Statement showing Live-stock on the Cattle Breeding Farm, Bankapur, for the year ending 30th June 1921.

Serial No.	Description.	No. of cattle purchased. 27-6-20.	Value.		Receipts during the year.		Deaths during the year.	Transferred from young stock and calved.	Total on hand.	Value.	
			Total.	Average.	Transferred from young stock and calves.	Born.				Average	Cost.
1	2	3	4	5	6	7	8	9	10	11	12
			Rs.	Rs. a. p.						Rs.	Rs.
1	Cows ...	22	4,075	185 4 0	5*				27	185	4,995
2	Heifers ...	9	1,400	155 9 0	1†			5*	5	155	775
3	Bull calves with ...	4	340	85 0 0					4	100	400
4	Bulls ...	2	1,175	587 8 0					2	587	1,174
5	Bullocks ...	4	1,200	300 0 0					4	300	1,200
6	Male calves ...					11			11	85	935
7	Female calves ...	2	150	75 0 0		8	2	1†	7	60	420
		43	8,340		6	19	2	6	60		9,899

* Heifers transferred to adult stock.

† Sucking calf transferred to heifers.

Report on Cattle Famine Work.

On the 3rd February 1921 instructions were received to start famine relief work. With the help of Mr. H. M. Desai, B.Ag., who had had previous experience of this work camps were started in Nagar and Poona districts. Mr. H. M. Desai laid out the plan on which these camps were to be worked. He actually managed the camps in both districts till he got them into smooth running order, when they were handed over to Mr. Hanmante and Mr. Hardikar, respectively.

Separate reports are being furnished for both these camps. Great credit is due to Mr. H. M. Desai for the way he worked in establishing not only these camps, but the advice given where necessary. Sholapur and Bijapur districts were visited by me or my staff and every assistance and advice was given where necessary.

Poona District.

Perna Camp.

A camp was opened on the 5th of March 1921 at Shikrapur in Sirur taluka. Owing to the shortage of water at Shikrapur the camp was shifted to Perna in Haveli taluka on the 3rd May 1921. Due to this shortage of water the cattle suffered a great deal. Rinderpest appeared among the cattle no less than four different times and it claimed a great number of casualties. The camp has not as yet been able to dispose of the cattle owing to the late appearance of the rains; so no definite report can be furnished till the camp actually closes. Mr. Hardikar has worked exceedingly well, considering the very hard time, he has had with the Rinderpest and other difficulties.

Ahmednagar District.

Rahuri Camp.

The camp was started on the 16th of February 1921 with 142 animals received from smaller camps previously opened by the Collector of Ahmednagar. The object of the camp was to save cattle from dying of starvation and being bought by butchers for slaughter.

The camp purchased in all 1,434 animals at a cost of Rs. 19-14-1 per animal or a total net cost of Rs. 23,605-0-0. The cattle were fed on mainly cactus with 2 lbs. of cotton-seed to balance the ration and 2 lbs. of grass to keep them from scouring. The daily cost to maintain the animal for one day works out at annas 4·03. The total cost of feeding all the cattle from the 16th February 1921 to 18th June 1921 works out at Rs. 36,789-13-10 or 21 per head for the period. The total cost of running the camp amounted to Rs. 65,394-13-10 and the total realization Rs. 65,118-6-0 showing a loss of Rs. 276-7-10. This loss is actually due to an error in judgment as the cattle were actually sold for 20 to 30 per cent. below market value. A number of cattle were sold by auction as a test and the prices realized were as stated above, a great deal more than that demanded at the camp. The average price realized per animal was Rs. 41. Cattle for the camp were purchased at cattle bazars in the Nagar district. At first only mature working bullocks were purchased as it was understood that this was the class of animal required by the cultivator. After a couple of weeks it was found that cattle of this description did not thrive very well on the ration given. It was decided to purchase young bullocks in good condition; these did exceptionally well and were the only class in demand when selling out. The cultivators purchased only such an animal whose price was likely to appreciate in value after finishing their work. The mature bullocks were eventually sold out at a loss to the camp.

Rinderpest broke out in the camp no less than three times but fortunately for the timely measure taken in segregating and inoculating the cattle, the loss was only 45 animals or 3 per cent. of the strength of the camp.

Cactus has no doubt proved its value in times of scarcity but the very labourers' nature of the work in preparing the cactus is much against its value as a fodder at any other period. It will not be out of place here to point out the following:—

I. Only young animals in fair condition thrive on cactus feed.

II. The average price of bullocks when ready for sale must not exceed Rs. 40.

Mr. Hanmante who purchased practically all the animals and managed the camp generally deserves great credit for the able manner he conducted the affairs of the camp and brought it to a successful close through a hard and trying time.

APPENDIX N.

Annual Report of the Agricultural Engineer, Poona, for the year ending 30th June 1921.

During the year under report I was again obliged to go home for a period of three months owing to the sad and untimely death of my wife. My Assistant Mr. Paranjpe acted for me during my absence and conducted the work efficiently. In the last report I referred to the Accountant General's Inspection of this office, the general opinion about the working of this Department, the increased routine work and inadequate staff. With the exception of boring (which needs much concentration especially at the moment) I am trying to curtail executive work in all directions. The development of the work actually done during the past 7 or 8 years is so extensive that the present executive staff is fully employed for the whole year round including the steam plough establishment even if the tackle is sold, in executing repairs of the plants and giving timely help to cultivators. Repairs to boring machines is a factor to be taken into consideration as the overhaul work is required to be completed during the rains only and it cannot possibly be done without the combined effort of the whole staff. This work is comparatively less in the fair season, but arrangements have to be made to attend to every call either for Government owned plants or private individuals and thus keep some men in readiness to attend to breakdowns. The introduction of new forms, the change of system in work and inadequate establishment has increased the routine work to such an extent that it has become almost impossible to divert attention from office work and attend to executive and research work for which this Department really exists. The Accountant General has been invited to revise the system again with a view to reduce office routine work if possible and simplify matters generally. I hope this will have the desired effect and give me and my expert staff more time for research work as the latter has been sadly neglected.

The activities of this Department are restricted more or less to the following:--*viz.*, Pumping, Boring, Cane Crushing, Steam and Motor Ploughing, Power Shredding and Baling and general advice regarding fixing power units intended for agricultural purposes. The following is a brief description of the work done under each heading.

Pumping.

This year the Nangaon Pumping Plant, which is at present irrigating 45 acres of cane and about 150 acres of crops in the Kharif and Rabi seasons, has been partly duplicated by a 12 N. H. P. Portable Steam Engine. The existing engine (37 B. H. P. Gas Plant) has also been thoroughly overhauled and a 10″ Victoria Turbine Pump with special connections and outfit kept in reserve. The Irrigation Department now thinks that the Plant should be self-supporting since the area under perrenial irrigation has been increased from 15 to 45 acres.

The Experimental well is being equipped again with the various water lifts which had to be taken away during the last famine. Five Pumping Plants as detailed in Schedule "A" have been installed for cultivators from the famine sets given on hire as regulated in G. R. No. 14124, dated 2nd December 1919, R. D. One Pumping Plant consisting of a 4 B. H. P. Standard Type Kerosine Oil Engine and a 2½″ Centrifugal Pump with piping connections, &c., has been erected for the Government Farm at Amalsad and repairs have also been carried out at various places. Experience has shown that in this particular section of the work the individual cultivator is usually short of funds for the proper tillage of his land after spending a good deal of money on a pumping installation. This has resulted in failure in some cases, without any fault of the machine either as regards design or erection. To demonstrate the use of modern pumping methods in agriculture I would strongly recommend that Government erect large installations at well selected sites on some of the most important rivers in the Presidency, and sell water to the cultivators as is done in the case of Nangaon Plant, in which case cultivators will only have to procure funds for tillage purposes which can be easily managed. This I believe would be a better investment than to advance Tagai loans on isolated Plants for individual cultivators because the latter require so much nursing even after the Pumping Plant is erected and the owner has taken charge.

Boring.

It is very gratifying to note that the Ryots appreciate the great usefulness of boring for drinking as well as for agricultural purposes. The demand, however, is so great that it is impossible to cope with it especially with the existing staff and machines, and that is why development in this section is absolutely essential. The physical conditions of the water bearing strata have, however, considerably changed during the last ten years especially in Gujarath owing to successive famines. During the famine of 1911 when the boring work was first started in Gujarath with Cawnpore machines, the water was tapped

within 100 feet from the surface, whereas now it is essentially necessary to bore 150 feet from the surface; consequently the Cawnpore machines being less efficient for this work are being scrapped. The Thana district is very promising as water can be tapped within 100 feet from the surface. The Kolaba district also shows signs of success as a bore 41' deep in a well at Palaspa, 3 miles from Panwel, on the side of a dry Nala, has tapped water which flows into the Nala during the month of April. The famine works in Nagar gave very poor signs of success but in Bijapur it is much more encouraging. Each Collectorate is provided with one or two machines but the number is regulated according to the demand in the district. This demand varies of course according to the success of the work done and that is why concentration is necessary in places where possibilities of success are greatest. Experience during the past 7 or 8 years proves that it is unwise to keep many machines in districts like West and East Khandesh, Nagar, Sholapur, Dharwar, Northern Canaras, Poona, part of Satara district where the demand does not justify more than a couple of machines. There is a great demand for tube-wells for drinking purposes and as this work cannot be taken at the cost of works for agricultural purposes during a fair season I have instructed each Assistant Boring Overseer to take up such works during the monsoons when a few machines can be spared. The owner of course is expected to build necessary sheds for executing the work during the rains. Considerable modification is necessary in the rules relating to boring operations and this will be discussed with the Director of Agriculture, at the earliest opportunity so as to avoid unnecessary dispute after the work is complete. In Schedules "B" and "C" are the details of work done in this connection during the year under report.

Cane Crushing.

Successive famines and the high price of machinery have retarded the progress of crushing cane by power. I am, however, glad to record that a big crushing installation consisting of a 32 B. H. P. Ruston Crude Oil Engine and a 6 Roller Maulove Cane Crusher with juice pump, &c., has been erected by Mr. S. Jirange of Kopergaon as the result of advice and designs given by this Department. I am strongly in favour of giving advice, desings and estimates but leave the actual purchase and erection to the cultivator. This saves a vast amount of work and makes the prospective power owner more careful.

Steam Ploughing.

The sale of the Steam Tackle at Ranebennur was in contemplation before the actual commencement of last working season but as no suitable offer was received in time, it was decided to continue to work the tackle at Ranebennur instead of keeping such valuable machinery idle. Late rains did not allow the work to commence before the 2nd of January 1921 and operations had to close on 17th April as further ploughing was impossible owing to intermittent showers. The total area ploughed was 438 acres and 11 gunthas in black cotton soil to a depth of 16 to 18 inches at Rs. 30 per acre and the total receipts amounted to Rs. 13,183-12-0 effecting a net profit of Rs. 1,092-7-2 on the whole concern exclusive of interest and depreciations. Better results are possible if the tackle *could* be worked for a longer period.

In my last report I had referred to the use of cultivating engines, for road rolling, stone breaking, &c., during the off season but the makers do not recommend this. I am not satisfied with such a casual comment and when purchasing tackle of this nature in future I should insist upon convertible sets, as the makers themselves are already putting on the market convertible sets so that the machinery can be employed regularly.

Tractor Ploughing.

This year comparative tests were taken with a couple of tractors of the 4 wheeled type and one Caterpillar type and from results obtained it is obvious that the track layer has a future. The Caterpillar type machines have a good many advantages over the four wheeled type and are better suited for deep ploughing and greater tractive power but there are more chances of wear and tear and there is a great difference of opinion amongst specialists as to which type of machine is to be preferred. Nothing but actual experience after comparative and exhaustive tests of both these types under identical conditions on different soils will decide this question. There is much to be done yet regarding the use of other agricultural implements in this country from ploughing to harvesting, and mechanical haulage to assist in marketing the crops. A model Farm under the direct control of this Department is in my opinion necessary to experiment on these lines.

Power Baling.

A large Forage Plant is being installed at Karajgi, the centre of a fodder growing area in Dharwar district, consisting of a 12 N. H. P. Double Cylinder Portable Steam

Engine, a chopping and bruising machine and a Forage Plant comprising a hydraulic pressure pump and 2 hydraulic presses with 4 boxes and connections. It is intended to shred Karbi and then have it baled by hydraulic means and stored for transport. All the operations will be practically automatic from feeding the Bruiser with Karbi to taking out ready made bales from the press. This is an improvement over the plant at Kopergaon as the Bruiser is mounted on an iron frame instead of timber and the press is hydraulic, instead of power-driven type. I shall give details of this in my next report after the plant has been working a season.

General.

The high cost of machinery has affected the demand for labour saving devices in all directions and when conditions become normal, I anticipate a great rush for agricultural machinery.

W. M. SCHUTTE,
Agricultural Engineer,
Bombay Presidency,
Poona.

SCHEDULE A.

Serial No.	Description of plant.	Place and District.	Source of water.	Name and party to whom plant is hired out.	Annual hire charge to Government.	Lift in feet.	Remarks.
					Rs.	Feet.	
1	16 Maximum B. H. P. Tangye Kerosine Oil Engine and a 3" Ruston Centrifigul Pump with piping and connection.	Patas, District Poona.	Well.	Mr. Gangajirao Sitole, Deshmukh of Patas.	450	40	
2	One 15 B. H. P. (Continuous) Blackstone Crude Oil Engine and a 3" Tangyes 3" High Lift Centrifugul Pump Complete with connections.	Ranjangaon, District Poona.	River. Bhima.	Mr. Narayanrao Kokaje of Ranjangaon.	550	70	This plant is erected on a well sunk on the bank of the river and directly connected to the stream.
3	One 7 maximum B. H. P. Tangye Kerosine Oil Engine and a 3" Ruston Centrifugal Pump with piping and connection.	Malegaon, District Nasik.	Well.	Mr. Pawar of Malegaon.	240	35	
4	One 14 (Continuous) B. H. P. Blackstone Kerosine Oil Engine and a 3" Tangye Centrifugal Pump with piping and connection.	Naigaon, District Nasik.	Well.	Mr. T. R. Chiplunkar.	450	40	
5	One 10 B. H. P. Ruston Kerosine Oil Engine and a 4" Guynes Centrifugal Pump with pipes and connections.	Bardi, District Thana.	Well.	Mr. Morubhau Marathe of Umbergaon.	326	35	

W. M. SCHUTTE,
Agricultural Engineer,
B. P., Poona.

SCHEDULE B.

Serial No.	Name of Work or the Name of the Land Owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of boring.	Cost per foot.	Result and Remarks
	Kaira District.			Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	Gosai Narayanrao Daolatrao.	Anand ...	Samerkha ...	3	43 0	2,000	8,000	146 6 8	46 13 0	193 3 8	4 7 11	Successful.
2	Pagi Shankar Bihari ...	Nadiad ...	Fatepur ...	3	50 0							Failure.
3	Gosai Narayanrao Daolatrao.	Anand ...	Samerkha ...	3	42 0	2,000	4,000	151 12 3	57 3 0	208 15 3	4 15 7	Successful.
4	Gosai Kailasgir Jaisamgir ...	Do. ...	Aras ...	3	144 0	4,000	12,000	476 10 8	135 8 0	612 2 8	4 4 0	Do.
5	Patel Ashabhai Purshotam.	Do. ...	Anand ...	4	148 0	6,000	7,000	777 9 7	204 12 0	982 5 7	6 1 2	Do.
6	,, Narayanbhai Jivabhai.	Nadiad ...	Uttersanda ...	3	68 0	1,000	3,000	169 2 3	102 0 0	271 2 3	4 10 10	Do.
7	,, Tapibhai Ichhabhai ...	Borsad ...	Dantalli ...	3	80 0	2,000	8,000	273 5 5	81 4 3	354 9 5	4 6 11	Do.
8	,, Motibhai Kashibhai ...	Mehmedabad ...	Udpuri ...	3	56 0	570	2,000	242 10 8	182 12 0	425 6 8	7 9 7	Do.
9	,, Dayabhai Mathurbhai.	Nadiad ...	Nursanda ...	3	50 0	500	1,000	133 9 0	26 2 0	159 11 0	3 3 1	Do.
10	,, Shiwabhai Nassibhai...	Borsad ...	Vadadla ...	3	111 0	2,000	5,000	375 1 0	210 8 0	585 9 0	5 4 6	Do.
11	,, Dayabhai Mathurabhai.	Nadiad ...	Kariavi ...	3	105 0	500	1,500	298 12 8	143 10 0	442 6 8	4 3 5	Do.
12	Gosai Mahadeogar Ram Thodyao.	Anand ...	Aras ...	3	133 0	3,000	7,000	438 14 2	141 0 0	579 14 2	4 5 9	Do
13	Desai Chhaganlal Nathiji ...	Kapadwanja ...	Patiabad ...	3	92 0	500	1,000	311 4 4	161 4 0	492 8 4	5 2 2	Do.
14	Pandya Bachulal Ramkrishna.	Anand ...	Anand ...	3	73 0	1,000	5,000	253 15 4	109 4 0	363 3 4	4 15 7	Do.
15	Patel Tuhirbhai Uttambhai.	Nadiad ...	Yatal ...	3	196 0	1,000	6,000	453 0 10	1,000 0 0	1,453 0 10	7 6 7	Do.
16	Pagi Babarbhai Mahirambhai.	Anand ...	Andand ...	3	115 0	500	3,500	252 8 0	165 0 0	470 8 0	3 10 1	Do.
17	Odabhai Raghubhai ...	Borsad ...	Vadadla ...	3	72 6	500	7,500	166 2 10	70 6 0	236 8 10	3 4 2	Do.
18	Patel Maganbhai Tribhuwan.	Mehmedabad ...	Sankli ...	2½	35 0	500	1,500	112 2 2	57 12 0	169 14 2	4 13 8	Do.
19	Patel Baber Hamkji ...	Borsad ...	Singlao ...	3	60 0	500	4,500	126 8 6	65 0 0	181 8 6	3 7 10	Do.
20	Patel Somabhai Jairambhai.	Nadiad ...	Tapipur ...	4	170 0	2,500	6,500	901 2 10	221 2 0	1,122 4 10	6 9 8	Do.
21	Patel Ashabhai Bhupatsing.	Borsad ...	Anwar ...	3	125 6	4,000	8,000	269 13 8	168 6 0	438 3 8	3 7 10	Do.
22	Patel Mangal Mulji ...	Do. ...	Dantal ...	3	95 0	500	4,500	229 1 7	127 3 0	356 4 7	3 12 0	Do.
23	Desai Keshavlal Chhaganbhai.	Kapadwanja ...	Mehmedapur ...	3	47 0	1,000	3,000	125 15 0	84 0 0	209 15 0	4 7 6	Do.
24	Patel Javarbhai Mahijibhai.	Borsad ...	Singlao ...	3	88 0	1,000	3,000	216 9 2	131 0 0	347 9 2	3 15 2	Do.
25	Vyas Dalpatram Khurdial ...	Kapadwanja ...	Torha ...	3	73 0							Failure.
26	Khant Shaiji Nathiji ...	Mehmedabad ...	Khalthi ...	3	69 0	500	1,500	184 2 0	115 4 0	299 6 0	4 5 5	Successful.
27	Desai Mameshbhai Motibhai.	Nadiad ...	Dabhai ...	4	32 0	4,000	12,000	183 15 4	67 8 0	251 7 4	7 13 9	Do.
28	Patel Purjibhai Lakhibhai...	Anand ...	Khadgood ...	3	76 0		1,000	174 0 10	229 8 0	404 8 10	5 12 5	Do.
29	Gosai Govindgir Ishwargir...	Borsad ...	Ankola ...	3	70 0	2,000	8,000	164 15 2	49 8 0	214 7 2	3 1 0	Do.
30	Desai Veerjilal Hiralal ...	Do. ...	Khadala ...		37 0	3,000	8,000	84 5 4	88 10 0	172 15 4	4 1 10	Do.
31	Laxmandas Raghunathdas ...	Do. ...	Neman ...	3	76 0	500	2,500	178 14 1	78 0 0	256 14 1	3 6 1	Do.
32	Ashabhai Kishorbhai ...	Anand ...	Gana ...	3	190 0							Incomplete
33	Patel Lathubhai Dada ...	Borsad ...	Dantali ...	3	78 0	500	3,500	166 12 7	82 0 0	248 12 7	3 3 0	Successful.
34	Desai Govindgir Ishwargir...	Do. ...	Ankola ...	3	58 0	2,000	6,000	148 10 2	57 0 0	205 10 2	3 8 9	Do.
35	Shavak Mathur Bahadur ...	Nadiad ...	Nadiad ...	3	115 0							Incomplete.
36	Patel Chaturbhai Mathurbhai.	Borsad ...	Naman ...	3	158 0	1,550	3,500	339 9 11	157 12 0	497 5 11	3 2 4	Successful.
37	Patel Meghji Ranchod ...	Mehmedabad ...	Kachhir ...	3	45 0	500	1,500	104 0 3	41 4 0	145 4 3	3 3 8	Do.
38	Vyas Pranshankar Asharam.	Kapadwanja ...	Torna ...	3	64 0	250	2,000	170 1 10	53 4 0	223 5 10	3 7 10	Do.
39	Fatesing Abhaising ...	Borsad ...	Napa ...	4	24 0	2,000	10,000	212 9 7	47 0 0	259 9 7	10 13 1	Do.
40	Andarsing Gajabhai ...	Mehmedabad ...	Kachhir ...	3	60 0	2,000	3,000	158 8 9	108 8 0	267 0 9	4 7 3	Do.
41	Shankarbhai Marghabhai ..	Borsad ...	Vadadla ...	3	98 0	1,000	2,000	204 10 0	163 12 0	386 6 0	3 12 0	Do.
42	Gosai Balvant Bhujangwan.	Do. ...	Ulas ...	3	90 0	1,500	2,500	203 4 11	121 0 0	324 4 11	3 1 8	Do.
43	Patel Chhaganbhai Lalubhai.	Kapadwanja ...	Torna ...	3	66 0	500	1,500	158 15 4	115 0 0	273 15 4	4 2 5	Do.
44	Patel Motibhai Narayanbhai.	Borsad ...	Gulel ...	3	95 0	9,000	12,000	201 15 1	48 12 0	250 11 1	2 10 3	Do.
45	Hirabhai Jethabhai Shah ...	Do. ...	Khalpur ...	4	100 0	10,000	15,000	552 11 4	119 9 0	672 4 4	6 11 7	Do.
46	Dawarbhai Lalubhai ...	Nadiad ...	Uttersanda ...	3	92 0							Incomplete
47	Hirabhai Narotamdas ...	Matar ...	Waswa ...	3	100 0							Do.
48	Raichand Madhavdas ...	Borsad ...	Jagar ...	3	96 0	1,000	5,000	212 8 6	220 6 0	432 11 6	4 8 2	Successful.
49	Prabhudas Baberbhai ...	Do. ...	Ras ...	3	120 0	750	4,750	244 12 4	120 12 0	365 8 4	3 0 9	Do.
50	Motibhai Dosubhai ..	Do. ...	Singlas ...	3	124 0	6,000	14,000	267 13 8	106 8 0	374 5 8	3 0 4	Do.
51	Patel Girdhar Ramchandra.	Do. ...	Ras ...	3	102 0	3,000	7,000	207 9 6	81 6 0	288 15 6	2 13 11	Do.
52	,, Jawarbhai Motibhai.	Do. ...	Singlas ...	3	157 0							Incomplete.
53	,, Girdharbhai Nassibhai.	Do. ...	Jesawa ...	3	100 0							Do.

Serial No.	Name of Work or the Name of the Land Owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of boring.	Cost per foot.	Result and Remarks.
				Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
	Kaira District—contd.											
54	Patel Motibhai Mosubhai ...	Borsad ...	Ras ...	3	113 0							Incomplete.
55	Chokshi Jetlal Nathubhai ...	Nadiad ...	Nadiad ...									Do.
56	Khant Amirji Johaji ...	Mehmedabad ...	Kachhi ...	3	26 0		6,000	102 1 1	45 4 0	147 5 1	5 10 8	Successful.
	Ahmedabad District.											
57	Vaghal Ramchand Jawabhai.	Sanad ...	Khoda ...	3	72 0	500	1,500	238 12 10	75 0 0	307 12 10	4 4 5	Successful.
58	Patel Tribhuwan Manichand.	Dashakrori ...	Lamba ...	3	69 0	1,000	3,000	242 9 8	118 0 0	369 9 8	5 3 7	Do.
59	Chandulal Masankhabhai ...	Dholka ...	Dholka ...	3	107 0							Failure.
60	Vaghal Ranchod Jiwabhai ...	Sanand ...	Khoda ...	3	86 0	1,000	3,000	265 3 10	80 0 0	354 3 10	4 0 1	Successful.
61	Chhalabhai Khodildas ...	Dashakrori ...	Lamba ...	3	138 0	500	1,000	331 5 10	250 8 0	581 13 10	4 3 5	Do.
62	Amritlal Kawishwar ...	Sanand ...	Khoda ...	3	200 0							Incomplete.
63	Northkote Cattle Farm ...	Do. ...	Chharodi ...	3	60 0							Failure.
64	Ambalal Chaganlal ...	Dholka ...	Dholka ...	3	40 0	250	1,750	99 12 1	88 8 0	188 4 7	4 11 13	Successful.
65	Northkote Cattle Farm ...	Sanand ...	Chharodi ...	3	200 0	1,000	2,500	848 2 0	474 1 6	1,322 3 6	6 9 9	Do.
66	Punjibhai Jaitanchand ...	Dashakrori ...	Lamba ...	3	60 0	1,000	2,000	184 15 3	121 0 0	305 15 3	4 10 2	Do.
67	Patel Chotalal Vagjibhai ...	Do. ...	Kubadthal ...	3	102 0							Incomplete.
	Broach District.											
68	Patel Jairam Kala ...	Ankleshwar ...	Diwa ...	3½	21 6	500	1,500	186 11 0	38 14 0	225 9 9	10 7 10	Successful.
69	Inamdar Tayab Usafali ...	Do. ...	Paraman. ...	3½	17 0							Incomplete.
70	Kachhibhai Narsi Howji ...	Do. ...	Chorsai ...	3	56 0							Failure.
71	Mithabhai Becharbhai ...	Broach ...	Broach ...	3	71 1	1,000	5,000	262 10 4	105 0 0	427 10 4	6 0 4	Successful.
72	Mulabhai Narsi ...	Ankleshwar ...	Ankleshwar ...	3½	21 0							Failure.
73	Muljibhai Lalubhai ...	Do. ...	Do. ...	4	66 0	1,000	3,000	329 14 1	96 12 0	426 10 6	6 7 5	Successful.
74	Motilal Bhukandas ...	Broach ...	Padarin ...	3	28 0		500	99 7 9	30 0 0	129 7 9	4 10 0	Do.
75	Patel Deoji Hira ...	Do. ...	Do. ...	3	64 0		500	159 8 3	30 0 0	189 8 3	2 15 5	Do.
76	,, Sorabha Kekabhai ..	Vaghere ...	Keshav ...	3	115 0							Failure.
77	,, Govardhan Jiwabhai.	Jambusar ...	Jambusar ...	3	98 0	2,000	10,000	211 6 2	219 0 0	430 6 2	4 12 6	Successful.
78	Vyas Shivshankar Jaishanker.	Do. ...	Kardi ...	3	77 0							Incomplete.
79	Chhotoolal Jethabhai ...	Ankleshwar ...	Ankleshwar ...	3	30 0							Do.
	Panch Mahals District.											
80	Thakoorsaheb of Bhameria .	Halol ...	Paikhanda ...	3½	67 0		500	106 11 2	250 3 0	356 15 2	5 5 3	Successful.
81	Manekal Shivlal Desai ...	Do. ...	Khandaiya ...	3½	16 0		500	36 0 5	42 8 0	78 8 5	4 14 6	Do.
82	Do. ...	Do. ..	Do. ...	6	14 0		500	35 15 11	37 8 0	73 7 11	5 4 0	Do.
83	Do. ...	Do. ...	Do. ...	4½	45 0		750	59 3 8	82 8 0	141 11 8	3 2 5	Do.
84	Vernacular Agricultural School.	Godhra ...	Dr's Muwda ...	4	93 0	250	450	114 6 11	350 0 0	464 6 11	5 0 9	Do.
85	Chhaganlal Rameshwar ...	Kalol ...	Kalol ...	3½	47 0	250	1,250	48 1 5	130 0 0	178 1 5	3 9 3	Do.
86	Jaising Pochandas ...	Do. ...	Chandapur ...	3½	36 0		1,000	53 9 11	81 0 0	134 9 11	3 11 10	Do.
	Incomplete Bores commenced in last year and completed in this year.											
	Kaira District.											
87	Chhotalal Dwarkadas ...	Mehmedabad ...	Samerkha ...	2½	86 0	250	1,250	233 4 1	199 0 0	432 4 1	5 0 5	Successful.
88	Ichhabhai Bapuji ...	Anand ...	Do. ...	3	60 0							Failure.
	Ahmedabad District.											
89	Bosangji Barjorji ...	Dhashakrori ...	Watwa ...	3	42 0	1,000	4,000	189 12 9	127 8 0	316 1 9	7 8 8	Successful.
	Panch Mahals District.											
90	Thakorsaheb of Bhameria ...	Halol ...	Bhameria ...	3½	26 0	500	1,500	79 8 7	112 4 0	191 12 7	6 0	Successful.
91	Thakorsaheb Punjabhai ...	Nadiad ...	Nadiad ...	3½	23 0	2,000	4,000	146 4 10	60 0 0	206 4 10	8 15 0	Do.
	Thana District.											
92	Framji Rustomji Khandadin.	Dahanu ...	Nargol ...	3	34 0	210	1,200	11 6 2	35 0 0	46 6 2	1 4 0	Successful.
93	Raghunath S. Mulege ...	Do. ...	Chikali ...	3	78 0							Failure.
94	Anandrao Gopinath Joshi ...	Mahim ...	Kelva ...	3	33 6		250	122 15 2	100 0 0	222 15 2	6 1 8	Successful.
95	Vithal Ramjee Pateel ...	Dahanu ...	Gholwad ...	3½	50 0	400	1,000	85 10 4	66 2 0	151 2 4	3 4 0	Do.
96	Tamnhe Pleader ...	Bhiwandi ...	Kalyan ...	3	50 0							Abandoned at the request of well owner.
97	Pestonji V. Kapadia ...	Salsetti ...	Malad ...	3	70 0							Failure.
98	Chotalal Ramdas Shroff. ...	Mahim ...	Palghar ...	6	69 0		900	239 0 0	97 8 0	336 8 9	4 14 0	Successful.
99	Rastomji Gazadhar ...	Salsetti ...	Malad ...									Abandoned.
100	Do. ...	Do. ...	Do. ...	3	56 0							Failure.
101	Cawasji Palunjee ...	Gholwad ...	Ichhapur ...	3	93 0	120	1,300	1 1 7	80 0 0	101 1 7	3 9 9	Successful.

Serial No.	Name of Work or the Name of the Land Owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of boring.	Cost per foot.	Result and Remarks.
				Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
	Thana District—contd.											
102	Narayan D. Deoderkar ...	Dahanu ...	Salsomba ...	3	56 0	100	500	72 9 6	75 6 0	147 15 6	2 10 3	Successful.
103	Raghunath S. Muley ...	Do. ...	Chikli ...	3	103 0	200	600	33 7 3	92 0 0	125 7 3	1 3 8	Do.
104	Trimbak R. Karve ...	Bhiwandi ...	Kelyan ...	3	18 0	500	1,000	39 8 3	100 0 0	139 8 3	1 12 0	Do.
105	Sub-Divisional Officer ...	Mahim ...	Palgher ...	6	78 0		400	223 5 6	10 0 0	233 5 6	2 15 3	Do.
106	Walabhadas Ranchoddas ...	Bhiwandi ...	Kelyan ...	3	22 0							Abandoned at the owner's request. Failure.
107	Mr. Hiralal R. Munim ...	Salsetti ...	Malad ...	3	70 0							
108	Bhalchandra A Dandekar ...	Mahim ...	Palghar ...	6	62	3,000	6,000	72 12 11	10 0 0	82 12 11	1 5 4	Successful.
109	Manekjee Sorabjee Jetha ...	Dahanu ...	Zai ...	4	45 0	1,000	2,000	22 2 9	48 8 0	71 1 2	1 9 3	Do.
110	Forest Officer (Ranger) ...	Basin ...	Gokhiwra ...	3	45 0		400	69 1 0	160 0 0	229 1 0	5 1 5	Do.
111	Bhalchandra A. Dandekar ...	Mahim ...	Palghar ...	6	84 0		1,200	282 3 0	10 0 0	292 3 0	3 7 7	Do.
112	Anand B. Walawelkar ...	Do. ...	Do. ...	6	62 0	200	600	58 2 4	7 8 0	65 10 2	1 10 11	Do.
113	Raghunath Anandji Patkar.	Do. ...	Do. ...	6	70 0	100	400	43 5 10	10 0 0	53 5 10	0 12 0	Do.
114	Krishnaji K. Dandekar ...	Do. ...	Do. ...	6	63 0		400	68 3 1	16 0 0	84 3 1	1 5 4	Do.
115	Sorabjee Shirjee Irani ...	Dahanu ...	Gholwad ...	3	52 0	200	2,000	67 13 9	93 12 0	161 9 9	3 1 6	Do.
116	Moreshwar Gopal Marathe.	Do. ...	Bardi ...	5	6 0							Abandoned.
117	Jagannath Gajanan Samant.	Mahim ...	Palghar ...	6	66 0	50	450	46 12 8	8 0 0	54 12 8	0 13 0	Successful.
118	Sorabjee Shirjee Irani ...	Dahanu ...	Gholwad ...	3	78 0	2,000	3,000	37 2 5	68 8 0	105 10 5	1 5 8	Do.
119	Jagannath Keshavlal ...	Salsettee ...	Malad ...	3	13 0							Abandoned.
120	Do. ...	Do ...	Do. ...	3	61 0							On hand.
121	Vaman Jiwan Raut ...	Dahanu ...	Bordi ...	3	50 0	900	2,400	55 15 4	52 8 0	108 7 4	2 2 8	Successful.
122	Pherojsha D. Malanwala.	Bhiad ...	Malav ...	3	7 8							On hand.
123	Gajanan Laxman More ...	Mahim ...	Zai ...	3	40 0	400	1,000	35 14 2	75 0 0	110 14 2	2 12 4	Successful.
124	Raghunath G. Dandekar ...	Do. ...	Palghar ...	6	24 0	200	300	27 0 0	10 0 0	37 0 0	1 2 5	Do.
125	Moreshwar G. Marathe ...	Dahanu ...	Bardi ...	5	8 0							On hand.
126	Hari S. Chaphekar ...	Mahim ...	Palghar ...	3	5 0							Incomplete.
127	Moreshwar D. Sathe ...	Mahim ...	Tarapur ...	4	16 6							Do.
	Nasik District.											
128	Shanker Sadasiv Tipre ...	Malegaon ...	Meheni ...	3	45 0							Abandoned.
129	Do. ...	Do. ...	Do. ...	3	17 0	500	1,000	25 4 6	19 12 0	45 6 0	2 10 4	Successful.
130	Do. ...	Do. ...	Do. ...	3	16 0	500	1,000	23 12 3	20 8 0	44 4 3	2 12 3	Do.
131	Pandoo Khandoo Mali ...	Nandgaon ...	Malawdi ...	3	52 0							Abandoned.
132	Do. ...	Do. ...	Do. ...	3	21 0	1,000	1,000	29 2 0	85 0 0	114 2 0	5 6 0	Successful.
133	Do. ...	Do. ...	Do. ...	3	62 0							Abandoned.
134	K. M. Pawar ...	Malegaon ...	Malegaon ...	3	54 0							Incomplete.
	Kolaba District.											
135	Mr. Ballal Mukund Tilak ...	Pen ...	Wavshi ...	3								Mishap of tool.
136	B. M. Hodiwala ...	Alibag ...	Uran ...	3	200 0							Abandoned.
137	Govt. Agricultural Farm ...	Do.	Alibag ...	3	17 6							Do.
138	Vishnu M. Govilkar ...	Panwel ...	Palaspa ...	3	41 0	500	1,000	30 14 3	64 2 0	95 0 3	2 5 0	Successful.
139	Do. ...	Do. ...	Do. ...	3	22 0		6,000	20 2 1	45 9 0	65 11 1	2 15 9	Do.
140	K. M. Talyarkhan ...	Do. ...	Panwel ...	3	19 6							On hand.
	Khandesh District.											
141	Villagers of Betawad ...	Jamner ...	Betawad ...	3	36 0							Abandoned.
142	Do. ...	Do. ...	Do. ...	3	10 0							Do.
143	Matsaram Ramjee Patel ...	Jalgaon ...	Nasarabad ...	3	8 4							Do.
	Poona District.											
144	Ibrahim & Co. ...	Haveli ...	Poona ...	3	91 0		500	30 15 4	54 4 0	85 3 4	2 9 3	Successful.
145	Tulphikir Abdulalli ...	Do. ...	Kirkee ...	3	103 3							Failure.
146	N. V. Khare ...	Do. ...	Katraj ...	3	12 9							Abandoned.
147	Govt. Agricultural School ...	Do. ...	Loni ...									Incomplete.
	Surat District.											
148	Mr. Murarjee J. Desai ...	Amalsad ...	Kacholi ...	3	200 0							Failure.
149	Raghunath N. Agte ...	Daman ...	Lawacha ...	3	35 0	2,000	4,000	22 14 11	62 8 0	85 6 11	2 7 0	Successful.
150	Do ...	Do. ...	Do. ...	3	40 0	4,000	6,000	47 3 6	50 0 0	97 3 6	2 6 10	Do.
151	Ardesar and Gulabbhai P. Dhantura.	Balsad ...	Balsad ...	3	30 0							On hand.

Serial No.	Name of Work, or the Name of the Land Owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of boring.	Cost per foot.	Result and Remarks.
				Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
	Satara District.											
152	A. M. Kuber ...	Man ...	Dahiwadi ...	4	65 0		250	79 6 0	43 0 0	122 6 0	1 14 1	Successful.
153	Do. ...	Do. ...	Do. ...	4	112 0		250	133 1 6	40 6 0	173 7 6	1 8 9	Do.
154	Do. ...	Do. ...	Do. ...	4	60 0		250	92 9 5	26 9 0	119 2 5	1 15 9	Do.
155	Annasaheb Mantri ...	Islampur ...	Islampur ...	4	105 0		250	69 11 4	241 9 0	311 4 4	2 15 6	Do.
156	Do. ...	Do. ...	Do. ...	4	175 9		250	139 14 11	344 6 0	484 4 11	2 12 1	Do.
157	R. S. Deshapande ...	Do. ...	Peth ...									Left at the request of owner.
	Bijapur District.											
158	Gurnath R. Bilgi ...	Bijapur. ...	Kakandki ...	3	32 0		720	53 0 5	61 12 0	114 12 5	3 9 5	Successful.
159	Do. ...	Do. ...	Do. ...	3	37 6		180	57 3 5	65 8 0	122 11 5	3 4 4	Do.
160	Tabanna Gurubasappa ...	Do. ...	Do. ...	3	57 0		240	50 10 6	82 8 0	112 2 6	2 7 0	Do.
161	Do. ...	Do. ...	Do. ...	3	30 0		480	34 8 3	65 8 0	100 0 3	3 5 4	Do.
162	Shivlingappa Rayappa ...	Do. ...	Do. ...	3	27 6		540	32 11 4	28 12 0	61 7 4	2 3 9	Do.
163	Do. ...	Do. ...	Do. ...	3	33 0		300	27 3 1	33 0 0	63 9 0	1 13 2	Do.
164	N. R. Utgi ...	Indi ...	Augutgi ...	3	23 0		240	29 6 4	24 10 0	54 0 4	2 5 7	Do.
165	Do. ...	Do. ...	Do. ...	3	50 0							Incomplete.
166	Campaign work ...	Kalatgi ...	Kajidoni ...	3	159 0		240	330 9 5	309 6 0	639 15 5	4 0 4	Successful.
	Dharwar District.											
167	Deputy Director of Agriculture.	Haveri ...	Karajgi ...	3	100 0		240	111 2 9	227 1 12	338 4 7	3 6 2	Do.
168	Allisaheb Chandsaheb ...	Shidgaon ...	Bankapur ...	3	24 0		250	32 6 10	120 0 0	152 6 10	1 5 7	Do.
169	Chikeri ...	Do. ...	Do. ...	3	22 3		250	27 6 5	90 0 0	117 6	5 4 5	Do.
170	Deputy Director of Agriculture.	Do. ...	Do. ...	3	210 0		250	292 15 1	519 1 6	812 0 7	3 12 1	Do.
171	N. G. Kalghatgi ...	Gadag ...	Gadag ...	3	39 0		350	36 5 6	79 14 0	116 3 6	5 3 7	Do.
172	Do. ...	Do. ...	Do. ...	3	18 6		240	18 7 0	23 0 0	41 7 1	2 3 10	Do.
173	Gadapur Municipality ...	Ranebennur ...	Dewarguda ...	3	68 0							Incomplete.
174	Deputy Director of Agriculture.	Haveri ...	Karajagi ...	3	101 6		240	82 12 8	185 0 11	267 13 7	2 10 3	Successful.
175	Do. ...	Do. ...	Do. ...		102 0		240	51 5 0	75 11 3	125 12 8	1 3 9	Do.
	Sholapur District.											
176	M. R. Godbole ...	Sholapur ...	Arjunsonda ...	3	42 0		250	25 1 1	55 0 0	80 1 1	1 14 6	Successful.
177	D. B. Khatri ...	Karmala ...	Kondej ...	3	50 6		240	53 9 11	131 4 0	184 13 11	3 5 4	Do.
178	Manager Laxmi Mills ...	Sholapur ...	Sholapur ...	3	35 0		250	32 8 11	75 12 0	108 4 11	3 1 6	Do.
179	Do. ...	Do. ...	Do. ...	3	40 6		250	54 4 5	75 12 0	130 0 5	3 3 4	Do.
180	Do. ...	Do. ...	Do. ...	3	46 0		250	61 3 6	69 8 0	130 11 6	2 13 6	Do.
	Belgaum District.											
181	Campaign Work ...	Kulgod ...	Kulgod ...	4								Incomplete.
	Kanara District.											
182	Govindrao Shetti ...	Honawar ...	Honawar ...	3	136 7		240	234 2 1	90 12 0	324 14 1	2 6 1	Successful.
	Ratnagiri District.											
183	Superintendent, Ratnagiri Farm.		Hatkhamba ...	3	111 0		240	46 9 11	Not known.			Do.
184	Do. ...		Do. ...	3	132 0							Incomplete.
	Famine Works conducted in Nagar District.											
185	Kharda Municipality ...	Jamkhed ...	Kharda ...	3	4 9							Abandoned.
186	Do. ...	Do. ...	Do. ...	3	101 0							Failure.
187	Do. ...	Do. ...	Do. ...	3	122 6							Do.
188	Do. ...	Do. ...	Do. ...	3	60 0							Do.
189	Do. ...	Do. ...	Do. ...	3	12 0							Abandoned.
190	Do. ...	Do. ...	Do. ...	3	102 6		250	20 4 2	37 13 0	58 1 2	0 9 0	Successful.
191	Do. ...	Do. ...	Do. ...	3	150 0							Failure.
192	Do. ...	Do. ...	Do. ...	3	37 0							Abandoned.
193	Do. ...	Do. ...	Do. ...	3	190 0							Failure.
194	Do. ...	Do. ...	Do. ...	3	163 0							Do.
195	Do. ...	Do. ...	Do. ...	3	119 6							Do.
196	Do. ...	Do. ...	Do. ...	3	40 6							Abandoned.
197	Do. ...	Do. ...	Do. ...	3	170							Failure.

W. M. SCHUTTE,
Agricultural Engineer,
B. P., Poona.

SCHEDULE C.

Particulars.	N. D.	C. D.	S. D.	Famine Work in Nagar District.	Total.
Bores made ...	91	60	33	13	197
Successful Broes ...	70	30	28	1	129
Unsuccessful Bores ...	8	6	0	12	26
Incomplete bores including on hand ...	13	11	3		27
Abandoned due to accidents or well-owner's request.		13	2		15
Total depth bored in season ...	7,042′ 0″	2,907′ 6″	2,391′ 2″	1,208′ 9″	13,549′ 5″
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Total cost of successful bores ...	25,129 10 4	3,593 1 10	6,035 1 3	58 1 2	34,815 14 7
Percentage of success ...	89·74	50·0	93·33	7·69	
Average number of working days for each bore.	19·3	11·58	16·8	18·5	
Number of accidents ...	5	7	6	1	
Number of accidents removed ...	5	6	5	1	
Average number of feet bored in one day ...	4·001	4·18	4·29	5·01	

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SCHEDULE D.

No.	Name of Tractor and Plough.	Date of purchase	Cost of Tractor and Plough.	Average Depth.	Average consumption of fuel in gallons.	Average time required for Ploughing one acre.	Average total cost of Ploughing one acre including interest depreciation, &c.	Remarks.
			Rs.		Per acre.	Hours.	Rs.	
1	Fordson Tractor with Oliver Plough 10-12 B. H. P.	7-11-19	4,350	5″to 6″	4 to 5	2½ to 3	9 to 10	Light tractor quite useless for deep ploughing; the weight is not proportionally distributed and consequently the front part jumps up which is dangerous to the driver, may be useful for ploughing on very Light Soil containing proper amount of moisture and for interculture.
2	Mogal Tractor with P. & O. Plough 8-16 B. H. P.	19-3-19	8,000	6″to 7″	7½ to 4½	2½ to 3	to 10	Shakes much as it has got only one cylinder, the clutch arrangement is not good.
3	Case Tractor with Grand Delour Plough 15 to 27 B. H. P.	8-10-19	7,250	7″to 8″	3½ to 4	2 to 2½	8 to 9	Very good in every respect except the clutch arrangement, is useful for comparatively deep ploughing in heavy soil and also for interculture.
4	Sanderson Tractor ...	29-10-20	7,000					Not a well balanced machine; it is very expensive in running also.
5	Cletrac Tractor ...	21-3-21	7,500	6″to 7″	4 gal.	2 o 2½	13 to 14	Most suited for medium soil for greater depth owing to greater grip of land due to the track layer.

W. M. SCHUTTE,
Agricultural Engineer,
B. P., Poona.

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